

Lepidoptera *Maynard M. Metcalf*
Malaise
PUBLIC DOCUMENT . OFFERLIN COLLEGE No. 73.
DEPARTMENT OF ZOOLOGY

Kirkland

FIRST ANNUAL REPORT

OF THE

SUPERINTENDENT

FOR

SUPPRESSING THE GYPSY AND
BROWN-TAIL MOTHS.

JANUARY, 1906.



BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
18 POST OFFICE SQUARE.
1906.

QL
548
M 31

FIRST ANNUAL REPORT

OF THE

SUPERINTENDENT

FOR

SUPPRESSING THE GYPSY AND
BROWN-TAIL MOTHS.

JANUARY, 1906.



BOSTON :

WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
18 POST OFFICE SQUARE.
1906.



APPROVED BY
THE STATE BOARD OF PUBLICATION.

Commonwealth of Massachusetts.

*To the Senate and House of Representatives of the Commonwealth of
Massachusetts.*

I present herewith for your consideration the report of the Superintendent for Suppressing the Gypsy and Brown-tail Moths. This report is submitted in accordance with the provisions of chapter 381, Acts of 1905, and contains a statement of the results accomplished to date, together with a record of expenditures and certain recommendations bearing on the future needs of the work.

A. H. KIRKLAND,
Superintendent.

BOSTON, Jan. 1, 1906.

ORGANIZATION.

A. H. KIRKLAND, M.S.,	.	.	.	<i>Superintendent.</i>
D. M. ROGERS,	.	.	.	<i>Assistant Superintendent.</i>
J. A. FARLEY,	.	.	.	<i>Secretary.</i>
F. A. BATES,	.	.	.	<i>Field Agent, Southern Division.</i>
J. W. ENWRIGHT,	.	.	.	<i>Field Agent, Northern Division.</i>
C. W. MINOTT,	.	.	.	<i>Field Agent, Western Division.</i>
L. H. WORTHLEY,	.	.	.	<i>Field Agent, Eastern Division.</i>

Commonwealth of Massachusetts.

THE GYPSY AND BROWN-TAIL MOTHS.

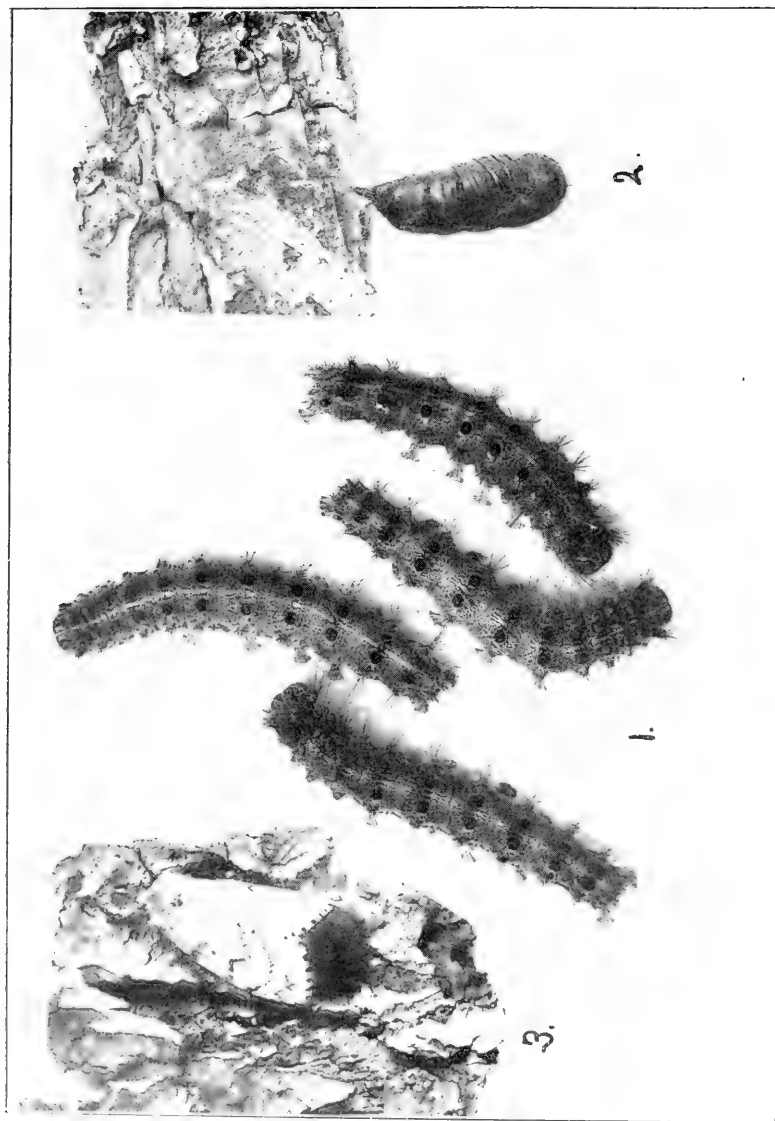
The gypsy and brown-tail moths in their caterpillar stage are well-known European pests of fruit, shade and forest trees. As far back as authentic records exist, both insects have been notably injurious at times in various sections of central and southern Europe.

The gypsy moth has made itself felt perhaps more as a general pest of trees of all kinds, while the brown-tail moth is more common as an enemy of fruit trees. In fact, the latter insect is known in France as "*la commune*," the common caterpillar. So common are both insects, and so important have been their intermittent ravages, that the very earliest writings on European entomology contain mention and often full discussions of their habits and of the remedies best suited to counteract their attacks. At times their ravages have so increased as to become of historic importance; then subsiding for a term of years, possibly even for a generation, they have increased again to noteworthy magnitude. The caterpillar plagues resulting from the unrestricted multiplication of these insects have often caused the enactment of stringent legislation in many European countries, and at other times their ravages have been even sufficient to cause official days of prayer and fasting.

The brown-tail moth has been officially under the ban of the Church, as witness the edict at Grenoble, France, in 1543, whereby the insect, which had stripped the trees of the city and poisoned many of the inhabitants, was treated as one of the works of the Evil One. Later in the same

century Chorier records a legal injunction issued by the attorney-general of the province of Dauphiny, whereby the insects were ordered to "forsake and abandon the fields" where they were feeding. Curtis published in 1782 a quaint account of an outbreak of the brown-tail moth near London, whereby "the inhabitants were thrown into the utmost consternation. An appearance so extraordinary was calculated to create terror; it was naturally interpreted as a visitation from heaven, ordained to deprive men and cattle of their food and finally leave them a prey to famine" (Donovan). The alarm of the public was so great and prevailed to such an extent that prayers were offered in the churches to avert the calamity.

The history of the gypsy moth in Europe and Asia is equally full of striking incidents. Thus in 1720 Frisch records the stripping "of a double row of lindens from Neustadt to Berlin," while Schaeffer mentions the defoliation of entire forests in 1752 in Altenburg, Leitz, Naumburg and elsewhere as a result of the unchecked ravages of the gypsy moth caterpillars. "Some of the common people thought the caterpillars grew out of the ground like grass; others thought they were created by the Evil One; still others assured the writer that they had seen thousands of caterpillars brought by the wind; and finally there were many who thought these insects were sent as a punishment for their sins." The stripping and serious damage to the cork oaks of southern France are recorded in 1731 by Brown, and a repetition of this injury occurred in 1818. Daudeville in 1828 described an outbreak extending over sixty miles near Saint Quentin, where the caterpillars "completely devastated the trees so that they were entirely bare." Later writers, like Ratzeburg, Bazin, Taschenberg, Portchinsky and Kœppen, have recorded notable outbreaks of the gypsy moth in Germany and Russia. Instances like the foregoing, authenticated by well-known entomologists, suffice to establish the status of the pest in its native region. It should be stated, however, that, in the careful study of the European literature bearing on this subject made by the writer several years ago, it was a significant fact that the history of any particular



Various stages of the gypsy moth.
1. Full-grown caterpillars. 2. Pupa. 3. Female moth laying egg cluster.
All figures life size.

outbreak did not extend over more than three or four years ; in other words, at the end of that period the moth was checked by natural causes and its damage subsided.

THE GYPSY MOTH.

In 1868 a French scientist, Prof. Leopold Trouvelot, then residing at Medford, Mass., imported egg clusters of the gypsy moth to use in certain experiments with silk-producing insects. The manner in which the moth escaped from his care could not be determined by correspondence with Professor Trouvelot after his return to France, but the late Alvan Clark, the well-known lens maker of Cambridge, who saw Trouvelot at Meudon, France, a short time before his death, was told by him that he had the caterpillars netted in on a shrub in his yard at Medford, and that during a gale the netting was torn and the insects scattered. It is a matter of record that he realized the importance of this catastrophe and promptly notified the public through the entomological magazines of that time. No attention appears to have been paid to this note of warning, and the insect, once becoming established, multiplied with increasing rapidity, until in the late eighties its ravages became notable in certain restricted districts of Medford and Malden. By 1889 the moth had become so abundant in southern Medford that the trees were completely stripped, and the caterpillars were forced to swarm outward in all directions in search of food. During this year specimens of the insect were sent to the Hatch Experiment Station at Amherst, where, in the absence abroad of Prof. C. H. Fernald, they were identified by his son, Dr. H. T. Fernald, as caterpillars of the notorious gypsy moth of the Old World.

After a vain struggle with the pest, the citizens of the affected communities petitioned in 1890 for legislation for its extermination, and similar action was taken by the State Board of Agriculture, the Essex County Horticultural Society and the Massachusetts Horticultural Society. The matter was presented to the Legislature by Governor John Q. A. Brackett, and on March 14, 1890, he approved the first act authorizing work against the moth, and carrying an appro-

priation of \$25,000. The work of combating the insect was begun by a commission consisting of W. W. Rawson of Arlington, Dr. Pearl Martin of Medford and J. Howard Bradley of Malden. The early work of the commission soon developed the fact that the territory occupied by the moth was much greater than had been supposed, and the matter was again presented to the Legislature, with the result that an additional appropriation of \$25,000 was made June 3, 1890.

The following year another commission, consisting of Prof. N. S. Shaler of Harvard University, Gen. F. H. Appleton and the Hon. W. R. Sessions, all members of the State Board of Agriculture, and the last named the secretary of the Board, was appointed by Governor W. E. Russell to direct the work. After a few weeks this commission was superseded by the State Board of Agriculture, which by a special committee, composed at first of the above-mentioned gentlemen, carried on the work against the gypsy moth from May 19, 1891, to Feb. 1, 1900, during which time the active field operations were under the direction of the well-known naturalist, Mr. E. H. Forbush, while the scientific and technical work was directed by Prof. C. H. Fernald. Without going into details, it may be said that the work by the committee of the Board of Agriculture, while dependent upon annual appropriations of the Legislature and often seriously delayed and restricted for lack of funds, was prosecuted with varying degrees of success until in 1899 the gypsy moth was completely under control throughout the district.

THE BROWN-TAIL MOTH.

This insect found its way to Somerville, Mass., in the early nineties. The evidence bearing upon its importation is entirely circumstantial, but it is matter of record that in the centre of the original brown-tail moth colony there is a florist's establishment which for years made a specialty of importing roses from abroad. It is also well known that the brown-tail moth spins its winter webs on rose bushes. Since the original infestation was located in a pear orchard adjoining the field where these foreign roses had been cultivated for several years, there is strong presumptive evidence

that the moth was brought over on these plants. The insect seems to have multiplied unnoticed for a few years in a restricted area, but in the spring of 1897 it gained sufficient headway to show itself as a serious pest in Somerville and in a few localities in Malden, Everett and Revere. The gypsy moth employees of the Board of Agriculture did a small amount of work against the insect in 1897 while the caterpillars were swarming, but this was discontinued after the Legislature declined to take action in the matter. In 1898 and again in 1899 \$10,000 was, by vote of the Legislature, set apart from the larger appropriations for work against the gypsy moth for the purpose of combating the brown-tail moth. This additional work was carried on under the direction of the Board of Agriculture.

THE FORMER STATE WORK BROUGHT TO A CLOSE.

At the close of 1899 the work against the gypsy moth was well in hand. Effective methods had been developed and their value proven; a trained and well-disciplined corps of men had been organized; the boundaries of the infested district had been determined with much accuracy; the street trees of the region had been freed from the caterpillars and their consequent spreading checked; the woodland colonies had been given a severe scourging and in some cases annihilated; the moths had been exterminated in many places; in short, the gypsy moth pest had been so thoroughly brought under control that a general state of apathy toward the work existed throughout the district which but a decade before had been swept by caterpillar hordes. In 1900 the Legislature, through a special committee, investigated the management and general policy of the Board of Agriculture's operations against the moth and came to the conclusion that a continuance of such work along these lines was unnecessary. The report of this committee argued that the gypsy moth need not be considered a serious pest: "We find no substantial evidence that gardens, crops or woodlands have suffered serious or lasting injury, or are likely, with that proper precaution or oversight which prudent owners are disposed to give to their own interests,

to be subjected to that devastation which one would have a right to anticipate from these reports. . . . It appears to us that the fears of the farmers throughout the State have been unnecessarily and unwarrantably aroused, evidently for the purpose of securing the effect of those fears upon the matter of the annual appropriations. . . . We do not share these exaggerated fears, and the prophecies of devastation and ruin are unwarranted, and in the most charitable view are but the fancies of honest enthusiasts."¹ While the committee recommended the continuation of the work on lines somewhat similar to those of the present act, the practical result of this report was the refusal of the Legislature to make any appropriation, and the State work was brought to a close.

UNRESTRICTED INCREASE OF THE MOTH.

As would have been expected, during the years 1900 and 1901 but little notable damage was caused by the gypsy moth, although evidence was not wanting to the trained observer that it was rapidly multiplying in woodlands and on neglected private estates. It was apparent that non-resident property owners particularly paid practically no attention to the increase of the insect, and that farmers and others owning infested woodland areas were unwilling, because of the expense, to fight the pest. In 1902 numerous estates were severely injured throughout the central district, while woodland colonies of some magnitude had developed from which the insects were swarming in all directions. The summer of 1903 showed that the moth had established itself again in alarming numbers in various parts of the infested district. Serious colonies had developed in the woods of Arlington, Medford, Saugus and Malden, and the Lynn Woods colonies had assumed notable proportions. In 1904 it was apparent to all that the gypsy moth had developed to a remarkable degree, reinfested the areas from which it had been cleared and even extended its bounds into previously non-infested territory. The caterpillar outbreak was sufficient to con-

¹ From report of special committee appointed to inquire into the state of the work of exterminating the gypsy moth. — House, No. 1138, March, 1900.



Menotomy Rocks Park, Arlington, devastated by gypsy moth caterpillars, June, 1905.

vince every tree lover of the necessity of concerted action against the moths. While in many places in the afflicted district the trees under the charge of municipal authorities were cared for with considerable success, private estates and woodlands in June and July presented shocking scenes of devastation. In many places the work of fire could not have been more thorough or alarming. From Belmont to Saugus and Lynn a continuous chain of woodland colonies presented a sight at once disgusting and pitiful. The hungry caterpillars of both species of moths swarmed everywhere; they dropped on persons, carriages, cars and automobiles, and were thus widely scattered. They invaded houses, swarmed into living and sleeping rooms and even made homes uninhabitable. Thousands of cases of poisoning of human beings resulted from the swarming of the brown-tail caterpillars. Real estate in the worst infested districts underwent a notable depreciation in value. Worst of all, pines and other conifers—altogether too scarce in eastern Massachusetts—were killed outright by the gypsy moth caterpillars, while shade trees and orchards were swept bare of foliage. Property owners who were disposed to care for their own estates suffered and became discouraged from the neglect of their neighbors. It was evident that the moth pests were in the ascendancy, and that they could be controlled only by prompt, thorough and systematic effort.

The experiences of the caterpillar season of 1904 resulted in the formation of various local associations, with the object of securing co-operative work against the moths among citizens of the several municipalities. Notable stimulus to public opinion followed the visit to the infested district, in the summer of 1904, of Prof. C. L. Marlatt, first assistant of the Bureau of Entomology, United States Department of Agriculture. After spending three weeks in an examination of the district, Professor Marlatt was outspoken in urging the necessity of renewing work against the moths on some comprehensive plan, which would secure the co-operation of the individual property owner, the municipality and the State. As a result of the various forces working toward a common end, late in 1904 the several local village im-

provement and anti-moth societies were organized into the Massachusetts Association for the Suppression of the Gypsy and Brown-tail Moths, under the presidency of the Hon. George R. Jones of Melrose, recently president of the Massachusetts Senate. A strong effort was made to harmonize conflicting ideas as to how best to proceed against the moth pest; and the efforts of the association, with the co-operation of the State Board of Agriculture, the Massachusetts Forestry Association and various other interested organizations and of individuals, finally resulted in the presentation of a bill to the Legislature to provide for the suppression of the gypsy and brown-tail moths. This bill, with various amendments, is the act under which the present work is carried on. It was signed by His Excellency Governor W. L. Douglas on May 8, 1905.

SCOPE AND PURPOSE OF THE ACT.

The underlying purpose of the present act (chapter 381, Acts of 1905) in relation to the gypsy and brown-tail moths is to secure the co-operation of the individual, the city or town and the State, each bearing a share of the responsibility for the work and each sharing in its expense. (1) The function of the State organization is first to secure systematic work in each city and town; to assist in the general campaign of educational work against the moths; and, by means of trained employees, to make a thorough examination of the infested district and to help train the local organizations to the maximum degree of efficiency. (2) The local organization of each municipality is charged with the enforcement of the law on private estates and with the care of the public trees. (3) The individual, within certain limits of expense, is required to destroy the moths on his property, under certain penalties for neglect. This general plan of work is a most admirable one, but for its success requires the intelligent and hearty co-operation by all parties interested. A brief summary of the essential features of the act may well be given at this point: —

The Moths are Public Nuisances.

The gypsy and brown-tail moths are declared public nuisances and their suppression is required.

The Superintendent of Suppression.

A superintendent appointed by the Governor, with power, subject to the Governor's approval, of appointing agents and assistants, has entire general charge of the work of suppressing the moths.

Duties of Cities, Towns and Individuals.

Cities and towns (under the advice and general direction of the superintendent, and by such agent as they may designate or appoint) are required, under penalty for neglect, to destroy the eggs, pupæ and nests of the gypsy and the brown-tail moths within their limits, *excepting* that such work is not to be done by cities and towns on property controlled by the Commonwealth; nor is it to be done upon private property, *excepting* where the owners of the same fail to destroy the eggs, pupæ and nests of the moths, in accordance with the terms of the official notice to private owners, noted in the section here following:—

Notice to Private Owners.

The mayor of every city and the selectmen of every town shall, at suitable times, notify every owner of land located therein which is infested with the moths, requiring him to destroy the eggs, pupæ and nests of the moths within a specified time.

When the mayor or selectmen decide that the cost of such destruction (on lands contiguous and under one ownership) will exceed one-half of one per cent of the assessed valuation of the lands, then they may designate in the notice a part only of such lands on which the destruction shall take place.

Failure of Private Owners to destroy Moths.

If the owner does not, as required by the terms of the aforesaid notice, destroy the eggs, pupæ and nests of the moths, then the city or town, subject to the approval of the State superintendent, shall destroy them, and shall assess upon such aforesaid lands the actual cost of so doing, to an amount, however, not exceeding one-half of one per cent. of the assessed valuation of the land.

This amount, so assessed, shall be collected in the form of taxes, and constitutes a lien upon such lands.

Redress by Abatement and Appeal.

The assessors may abate the moth assessment in the case of any private land owner decided by them to be unable to pay it because of age, infirmity or poverty.

Appeal to the county superior court, with special provision for prompt hearing, is provided by the statute for any person aggrieved by assessment on account of this work; provided a complaint is entered within thirty days of notice of such assessment.

Appropriation by the Commonwealth.

To meet the expenses incurred under its moth-suppression law, the Commonwealth has appropriated \$300,000. Of this sum, \$75,000 may be expended during 1905, \$150,000 (and any unexpended balance) during 1906, and \$75,000 (and any unexpended balance) during 1907, up to May 1, 1907, inclusive.

For the purpose of experimenting with natural enemies for destroying the moths \$10,000 is additionally appropriated for each of the years 1905, 1906 and 1907.

Reimbursements to Cities and Towns.

1. Cities and towns with valuation of real and personal estate of \$12,500,000 or more, having spent \$5,000 in any one calendar year, shall be reimbursed annually fifty per cent (one-half) of all further expenditure.

2. Cities and towns with valuation less than \$12,500,000 and more than \$6,000,000, having spent an amount equal to one-twenty-fifth of one per cent of such valuation in one year, shall be reimbursed annually eighty per cent (four-fifths) of all further expenditure.

3. Towns with valuation less than \$6,000,000, having spent an amount equal to one-twenty-fifth of one per cent of such valuation in one year, shall be reimbursed once in sixty days for all further expenditure.

Limits to required Expenditure by Cities and Towns.

No city or town with an assessed real and personal valuation of more than \$6,000,000 shall be required to expend in the suppression of the moths, during any one full year, more than one-fifteenth of one per cent of such valuation. No town with an assessed real and personal valuation of less than \$6,000,000 shall be required to thus expend during any one full year more than one-twenty-fifth of one per cent of such valuation.

Valuations of 1904 taken as Basis.

Wherever valuations of real and personal property are referred to in the gypsy and brown-tail moth suppression law, the valuations of 1904 are meant.

Wilful Resistance or Obstruction.

Wilful resistance to or obstruction of any agent of the Commonwealth or of any city or town, while lawfully engaged in the execution of the purposes of the moth-suppression law, is forbidden under penalty.

THE WORK BEGUN.

On May 8 the writer was called from New York, where he was located at the time, at the request of His Excellency W. L. Douglas, Governor of Massachusetts, to consider accepting the position of superintendent for suppressing the gypsy and brown-tail moths, and at an interview with His Excellency May 10 the appointment was tendered. This offer was wholly unexpected and unsolicited in any way. The writer at once returned to New York and laid the case fully before the business interests with which he was connected. A release of services having been secured, he returned to Boston, and on May 15 qualified for the office.

It was apparent that considerable time and effort must be expended in preliminary work. There was no exact knowledge of the bounds of the infested district; no organization was available for work; the trained employees of the Board of Agriculture had become widely scattered; the somewhat complex provisions of the law required careful study; an office force had to be organized and a careful system of accounting devised, while tentative plans of work were required almost immediately. The only available assets, if such they may be called, were the knowledge of effective methods as developed by the previous State work, the records preserved by the Board of Agriculture and particularly the availability of a limited number of trained men familiar with the moths. The services of these men have been of the greatest value.

On May 16 the office of the Superintendent for Suppressing the Gypsy and Brown-tail Moths was established in its present location. As rapidly as possible, a nucleus of a force of agents and inspectors was obtained, and frequent conferences were held with the Attorney-General for information and rulings concerning the law under which the superintendent was to act. During the remainder of the month the work of organizing the office and field force was pushed as rapidly as possible, a system of bookkeeping developed and necessary details attended to.

ORGANIZATION OF THE OFFICE.

The matter of developing a proper system of accounting received early attention. It was apparent at a glance that, under the somewhat complicated provisions of the law, accounts would necessarily be opened with all the cities and towns of the district, while other arrangements must be made for the accurate recording of the various classes of expenditures so that their totals might be determined at any time without delay. A modification of a system of bookkeeping which has been successfully employed by one of our largest corporations was adopted, arrangements made for the necessary books, vouchers and records, and letters sent to the known infested cities and towns requesting the name of the person or board who would have charge of executing the provisions of the law.

The superintendent, being unable to attend unaided to the organizing of the work, as well as to answering the numerous inquiries for information and assistance which were continually pouring in, was assisted in the office by the field agent first appointed, Mr. J. A. Farley, late of the United States Biological Survey. Mr. Farley brings to the present work technical knowledge of great value, while his long experience in the former State work against the moths has made his services particularly desirable.

During May and June the superintendent held conferences almost nightly with city and town boards, explaining to them the requirements of the law and soliciting their co-operation in suppressing the moth pest.



Thousands of gypsy moth caterpillars clustered at base of banded tree. Arlington, June, 1905.

PLAN OF WORK.

It was apparent that the work must progress along two lines: first, to obtain an accurate knowledge of the extent of the infested area; and second, to organize work against the moth in the cities and towns where the caterpillar plague was already in evidence. Until the bounds of the infested district were known, and a general idea of the severity of the infestation was obtained, no final apportionment of the State appropriation could be made. On the other hand, the need of a large amount of immediate work was obvious, particularly in the badly infested central cities and towns. To carry on these dual lines of effort the territory was roughly divided into four divisions, each being placed in charge of a field agent who had had large experience in work against the moth as well as in handling men and in dealing with the public. Under these agents were placed a certain number of trained inspectors, whose work at first was principally that of examining outlying territory, while the agents devoted their efforts toward organizing municipal operations in the central region. When the scouting had been brought to a close, the operations were well under way in a large number of cities and towns, and the inspectors were then detailed to follow up this local work, to co-operate with the local superintendents, and, when necessary, to instruct them in the most efficient methods of combating the pests.

In selecting employees it has been the policy of the superintendent to hire only men of experience and proved ability in the work against the moth pests. It has seemed unwise to employ untrained men in the execution of this law so long as the services of experienced men could be obtained. This has resulted in the disappointment of a great many applicants for employment, but the superintendent has felt that only by insisting on the highest grade of efficient service could the insects be brought under control.

MAPPING THE INFESTED TERRITORY.

The problem of first importance was to determine the extent of the infested territory. As is well known, the area occupied by the gypsy moth in 1899 embraced 359 square

miles. In the time which had elapsed between the cessation of the work of the State Board of Agriculture and the beginning of the work under the present superintendent, 8 additional infested municipalities were reported from various sources, namely, Billerica, East Bridgewater, Framingham, Gloucester, North Andover, North Reading, Scituate and Weston. This added to the known infested district an area of 191 square miles, making a total of 550 square miles.

It was well known to the superintendent that a large spreading of the moth had occurred from the badly infested sections lying immediately to the north of Boston. The spreading of the caterpillars through the agencies of traffic is a well-established fact. It was impossible to ride through Medford, Malden, Saugus or Arlington during May or June of 1904 and 1905 without becoming covered with gypsy moth caterpillars, and it was evident that a large spreading of the insect had taken place. To determine just how far the moth pest had spread, and to ascertain the size of the problem on hand, a corps of about 10 trained men was organized and sent out into the regions suspected but not known to be infested, to the north, south and west of the moth-area of 1899. These men had had the benefit of several years' experience in gypsy moth work for the Board of Agriculture, were thoroughly familiar with the moth and its habits, and were known to the superintendent to be reliable and trustworthy. After the territory was divided among these inspectors, they were instructed to make a diligent search for the moths, and after finding them in any city or town to spend several days in scouting to develop the local situation, and then push on to the next town.

The result of this examination of the outlying territory was most astonishing. Town after town in all directions was found infested, and not until fall was the outer edge of the infestation reached. This border line comprises Salisbury, Amesbury, Merrimac, Haverhill, Methuen, Andover, Tewksbury, Chelmsford, Carlisle, Acton, Stow, Hudson, Marlborough, Southborough, Hopkinton, Ashland, Sherborn, Dover, Westwood, Norwood, Canton, Stoughton,

Brockton, West Bridgewater, Bridgewater, Middleborough, Lakeville, Wareham and Plymouth.

Outside this line a complete belt of towns has been scouted without finding the gypsy moth. Briefly, the whole of Essex County, over one-half of Middlesex County, half of Norfolk County and practically the entire county of Plymouth were found to be infested. As against 359 square miles of territory infested in 1900, we now have a total of 2,224 square miles occupied by the gypsy moth in varying numbers. In other words, the territory to-day is nearly six times as great as when the work of the State Board of Agriculture was abandoned. (See map.)

Presented in tabular form, the infested district by periods is given below: —

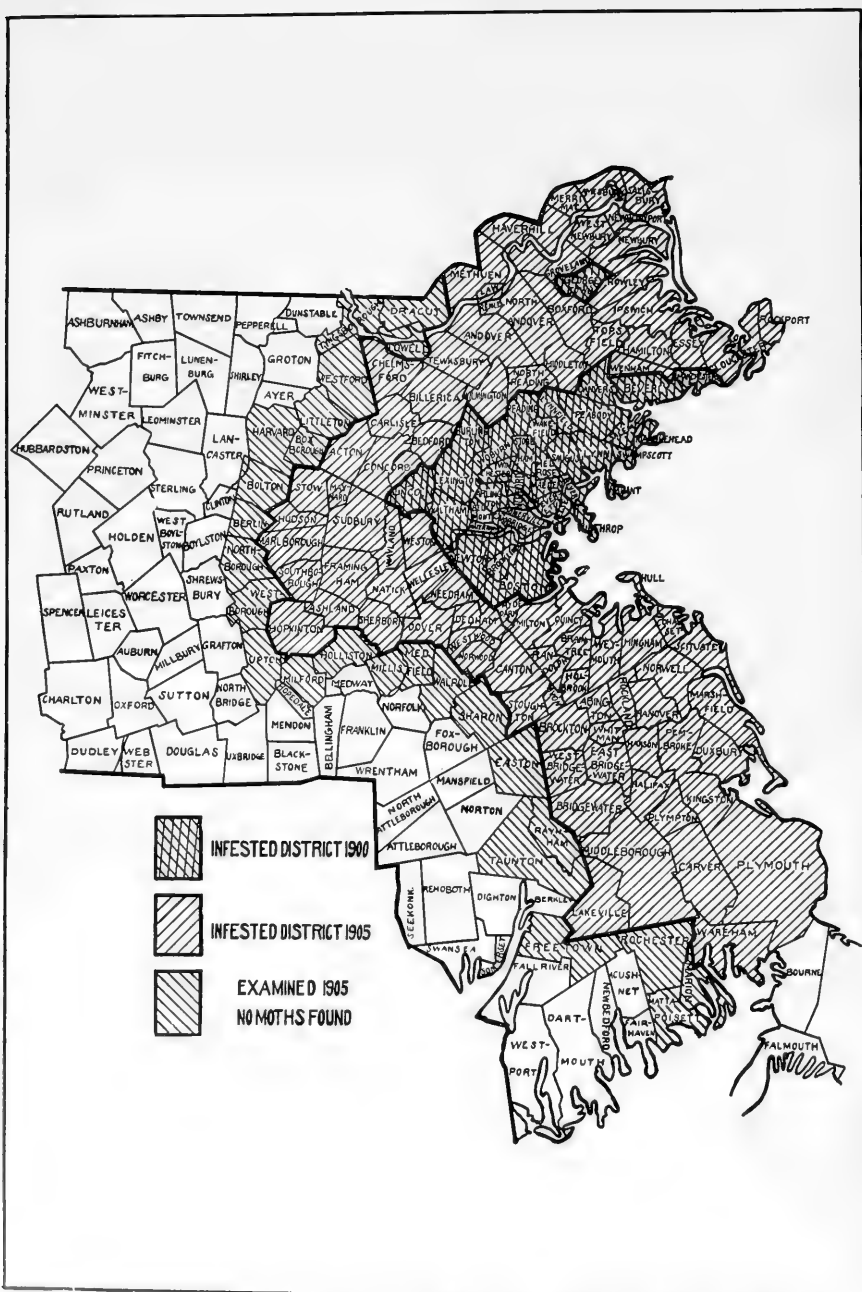
DATE.	Number of Cities and Towns.	Area in Square Miles.
1900,	34	359
1905,	124	2,224

The present infested district embraces nearly one-fourth of the entire area of the State. While, as previously stated, a row of towns along the outer border has been scouted without finding evidence of the moth, it should not be inferred that the insect does not occur in these towns or even in places farther from the known infested district. It should be remembered that a scouting of a week's duration in the caterpillar season may not disclose the presence of the moth when it is in small numbers, but that it may be readily detected later after its buff egg clusters have been laid and are revealed by the falling of the leaves. The fact that a summer scouting reveals no moths is at best but negative evidence.

The infestations found varied greatly in extent, growing less as the distance from the central infested district increased. The section south of Boston, uninfested in 1900 and now completely infested, well illustrates this point.

Quincy and Braintree were found to be generally infested; and in Weymouth, Hingham, Cohasset and Hull a considerable number of moths were found. South of this section the infestations diminished in size, until at Lakeville, Middleborough and Wareham only a few specimens of the insect were discovered. The presence of the moth, even in small numbers, in these outlying districts is of grave significance, since only a few years are necessary for the insect to become thoroughly established where remedial and preventive measures are not diligently employed.

That the automobile has been an important factor in the distribution of the gypsy moth within the past three years does not admit of dispute. It was impossible to ride through the infested sections immediately to the north of Boston without becoming thoroughly coated with caterpillars during the spring months of 1903, 1904 and 1905. During the current year, in the caterpillar season, the superintendent had occasion to keep a rough record of the number of gypsy moth caterpillars found on himself and vehicle after trips through the infested district, and this varied from 3 to 129. Automobiles, with the wide surface on which the caterpillars may rest, will, of course, intercept more of these as they spin down than a carriage or other vehicle. Where pleasure driving or teaming is limited in a day's trip to from 10 to 20 miles, the automobile in the same time passes over from 40 to 100 miles. It is of great significance that the places where automobilists are accustomed to stop for meals or supplies are most generally infested by the gypsy moth. Favorite trips with the automobile are to Gloucester, Newburyport and Plymouth. All these places are now known to be infested by the gypsy moth, in fact, the insects occur there in much greater numbers than even in the intervening territory. The means of distribution will be more fully treated in another place.



Gypsy moth infested district in Massachusetts: 1900, 359 square miles; 1905, 2,224 square miles.

*List of Towns and Cities infested by the Gypsy Moth,
Jan. 1, 1906.*

Abington.	Hanson.	Plympton.
Acton.	Haverhill.	Quincy.
Amesbury.	Hingham.	Randolph.
Andover.	Holbrook.	Reading.
Arlington.	Hopkinton.	Revere.
Ashland.	Hudson.	Rockland.
Avon.	Hull.	Rockport.
Barnstable.	Hyde Park.	Rowley.
Bedford.	Ipswich.	Salem.
Belmont.	Kingston.	Salisbury.
Beverly.	Lakeville.	Saugus.
Billerica.	Lawrence.	Scituate.
Boston.	Lexington.	Sherborn.
Bourne.	Lincoln.	Somerville.
Boxford.	Lynn.	Southborough.
Braintree.	Lynnfield.	Stoneham.
Bridgewater.	Malden.	Stoughton.
Brockton.	Manchester.	Stow.
Brookline.	Marblehead.	Sudbury.
Burlington.	Marlborough.	Swampscott.
Cambridge.	Marshfield.	Tewksbury.
Canton.	Maynard.	Topsfield.
Carlisle.	Medford.	Wakefield.
Carver.	Melrose.	Waltham.
Chelmsford.	Merrimac.	Wareham.
Chelsea.	Methuen.	Watertown.
Cohasset.	Middleborough.	Wayland.
Concord.	Middleton.	Wellesley.
Danvers.	Milton.	Wenham.
Dedham.	Nahant.	West Bridgewater.
Dover.	Natick.	West Newbury.
Duxbury.	Needham.	Weston.
East Bridgewater.	Newbury.	Westwood.
Essex.	Newburyport.	Weymouth.
Everett.	Newton.	Whitman.
Framingham.	North Andover.	Wilmington.
Georgetown.	North Reading.	Winchester.
Gloucester.	Norwell.	Winthrop.
Groveland.	Norwood.	Woburn.
Halifax.	Peabody.	Yarmouth.
Hamilton.	Pembroke.	
Hanover.	Plymouth.	

MOTH COLONIES OUTSIDE OF MASSACHUSETTS.

The development of serious infestations of the moths in neighboring States is at present of importance to the work in this Commonwealth only so far as the danger of the reinfestation of our cleared towns is concerned. That such colonies do exist outside the State practically confines the policy of work in Massachusetts to suppression only, without attempt to reach absolute extermination. In fact, the time when either pest could have been exterminated has long since passed. The superintendent has kept in touch with the developments in the neighboring States through correspondence with experts interested in the matter, and is thus enabled to present a brief summary of the conditions there existing.

Gypsy Moth.

At Providence, R. I., there now exists a considerable, widely diffused gypsy moth colony in the residential section. Egg clusters are common in street trees in many parts of the city, and as a result there has been and will continue to be a continuous scattering of caterpillars by means of vehicles—a scattering which will increase yearly unless vigorous action is taken against the pest. The apathy of the authorities who should deal with the matter is regrettable. If the moth is neglected, the trees of Providence will soon suffer severely, while it is quite possible that from this large colony a part of the southern border of Massachusetts now free from the pest will be exposed to infestation.

After the central office inspectors had located the gypsy moth along the New Hampshire border, from Methuen to Salisbury, the superintendent communicated with State Entomologist E. D. Sanderson at Durham, N. H., and suggested that the insect probably occurred in that State, and that it would be most desirable to have an examination made there by a trained man. At Professor Sanderson's request Inspector John Sweeney was temporarily released from our service, and in a few weeks' time located the moth along the coast line from Seabrook to Portsmouth—a notable avenue of travel. So far no gypsy moths have been found in Maine.



Typical badly infested roadside. Lexington, Mass., September, 1905.
Until the brush has been cut and burned, street trees cannot be kept free from gypsy moth caterpillars,
and scattering by vehicles will continue.

Brown-tail Moth.

A single finding of this insect has been reported from Providence. Prof. W. E. Britton of the Connecticut Experiment Station, New Haven, states that to his knowledge no findings have been made in his State.

The two lower tiers of counties in New Hampshire are generally infested with the brown-tail moth, and Professor Sanderson has had specimens sent him from the White Mountain region. Notable flights of the moths have been observed at Nashua, Concord and Portsmouth.

In Maine Prof. E. D. Hitchings, State Entomologist, Waterville, has found the pest scattered along the coast in various places. Portland, Rockland and Augusta are generally infested, while sufficient numbers of the moths have been found at Bar Harbor to warrant local work against the insect. The moth has also been reported at Eastport and at St. John, N. B.

In eight years' time this strong-flying insect has become disseminated along the entire eastern seacoast of New England and westward to central Massachusetts and southern New Hampshire. Even Martha's Vineyard and Nantucket have not escaped its visitation.

ORGANIZATION OF TOWN WORK.

The moth pest had made itself felt so severely in recent years in the central municipalities that some of them already had local organizations for combating it, or at least had made an attempt to destroy the nests of the gypsy and brown-tail moths on street and park trees. In other towns and cities, village improvement societies, women's clubs and similar bodies had accomplished a great amount of good, particularly in arousing property owners to the importance and necessity of destroying the moths, but, in spite of all this good work, there were throughout the district most numerous and discouraging examples of neglected estates where the pests swarmed in full force.

The provision of the necessary funds for prosecuting the work was early urged on the worst afflicted municipalities. It was found that in many cases the municipal budget had

already been made up, and that, despite the caterpillar nuisance, it was difficult to secure appropriations in season for effective work. In the case of many towns a special town meeting was necessary, and all these delays militated strongly against the success of the season's efforts.

An additional reason for delaying local appropriations was found in the fact that many municipalities had already made large expenditures before the passage of the act for which no reimbursement could be obtained. Thus the city of Salem spent nearly \$8,000 during the winter and spring preceding the enactment of the law, while Medford, Somerville, Cambridge and many other communities had already made liberal expenditures. While the request for additional large appropriations may have appeared as a hardship to some communities, it should be borne in mind that the expenditures previously made had resulted in reducing the amount of work necessary during the season of 1905.

In some cases there was evident a marked tendency to delay making appropriations and in a few a strong attempt to bring the work within the sphere of local politics, a state of affairs which seems as remarkable as it is unfortunate. The problem of combating the two moths calls for the best thought and the heartiest co-operation of every one interested in preserving our trees from harm, and it is evident that it ought to be treated as a business proposition, pure and simple, without reference to political considerations of any kind. The cost of the work will be great, even with a maximum of efficiency and the utmost economy. While the regrettable conditions mentioned have obtained in the case of a few municipalities, the response from the cities and towns as a whole has been most hearty and encouraging. They have taken a broad view of the situation, have provided the necessary funds, have placed competent men in charge of the work and have endeavored to prosecute it vigorously and effectively. In many places citizens having large business interests have gladly taken up the burden of directing the work, and have given freely of their time and often of their personal funds in the effort to suppress the moths. Where public service can command the well-trained energies of

such citizens, efficient work and encouraging results must follow. In other places men familiar with the moths have been placed in direct charge of field operations, and have rendered most faithful service. It has been most helpful and gratifying to the superintendent to have, almost without exception, the hearty co-operation of this corps of local superintendents, and to them in large measure is due the credit for the results so far obtained. There has been good "team work" all along the line, and if this condition can continue and the necessary funds are available, success in the end will be attained.

With the assurance of systematic work throughout the district, and that no town's efforts should suffer from the neglect of the adjoining municipalities, the appropriations were as a whole freely made and the work inaugurated. At the present writing 95 cities and towns out of the total of 124 infested with the gypsy moth have a more or less complete organization for combating the moths, and upward of 1,500 men are so employed. In the remaining towns, only scattering nests of the gypsy moth were found by the inspectors, and but little work, relatively speaking, will be required.

As soon as fall work was well under way, the demands on the superintendent's time, both in field and office, became greatly increased. Town and city officials in large numbers sought the office for advice, while special problems in field work needing attention constantly presented themselves. To assist in attending to these matters promptly, with the approval of the Governor, Agent Dexter M. Rogers of the eastern division was transferred to the office as assistant superintendent, where his experience and knowledge of the work have been most helpful.

It is always a pleasant duty to acknowledge help received from others. The superintendent has sought freely the advice of the Attorney-General, the Auditor of the Commonwealth and the secretary of the Board of Agriculture, and in every case their counsel and assistance have been as freely given. The suggestions of the officials and several members of the Massachusetts Association for the Suppression of the Gypsy and Brown-tail Moths have been par-

ticularly helpful. Finally, the superintendent is glad to acknowledge his obligation to field agents F. A. Bates, J. W. Enwright, C. W. Minott and L. H. Worthley, in charge of the four divisions, men who have brought to this work a thorough training and well-ripened judgment, and who have been at all times closely in touch with the field operations. The superintendent's thanks are also due to the local superintendents of the various cities and towns, and to the inspectors employed by the central office, for hearty co-operation and faithful service.

POLICY OF WORK AGAINST EACH SPECIES OF MOTH.

As soon as the size of the gypsy moth infested area was determined, it became necessary to decide on the course to follow with reference to each species of moth. The gypsy moth had been found from the New Hampshire line to Buzzard's Bay and westward to Marlborough. Outside the State it was known to exist at Providence, R. I., and to be scattered along the New Hampshire seacoast to Portsmouth. The brown-tail moth had been reported at Amherst, and was known to occur at Fitchburg and Worcester. It extended south to Cape Cod and north throughout southern New Hampshire and along the Maine coast to Eastport, thus having a much wider distribution than the gypsy moth. Since the funds available were wholly insufficient to cope with both pests, it was decided to adopt the policy of suppressing the gypsy moth so far as possible wherever it occurred, and to confine work against the brown-tail moth to clearing street trees and trees around or near residences. The following reasons governed the decision:—

1. The gypsy moth spreads slowly, almost entirely by the agencies of traffic. The female moth does not fly.

The brown-tail moth is a strong flyer and is borne by the wind for many miles.

2. The gypsy moth is a serious pest of all trees, both deciduous and coniferous, and attacks all shrubs and sometimes even crops.

The brown-tail moth attacks deciduous trees, and is mainly a pest of fruit trees and oaks.



Various stages of brown-tail moth.

1. Female moths laying eggs (slightly enlarged).
2. Egg masses.
3. Caterpillars.
4. Cocoons in hickory leaves, with moths of both sexes emerging (much reduced).

3. The gypsy moth is often hard to find, even when abundant, and its treatment calls for a high degree of skill as well as a liberal outlay of money.

The brown-tail moth is easily found in winter when its webs are prominent at the tips of twigs. Its destruction is relatively inexpensive and calls for no particular skill.

4. But few gypsy moths are likely to reach Massachusetts from the small colonies outside the State.

A strong northerly wind during the flying season would blow into Massachusetts multitudes of brown-tail moths from the now badly infested New Hampshire border and from southwestern Maine.

The facts being as above stated, it seemed to the superintendent unwise to authorize large expenditures of money in combating the brown-tail moth in woodlands, while in the case of the slow-spreading and more dangerous gypsy moth it was obvious that every possible effort should be made to stamp it out wherever it occurred. It was therefore decided to urge upon the local superintendents of work the necessity of destroying the brown-tail moth on street trees, and of insisting that every property owner destroy the pest on his house lot and in his orchard, should he have one. In this way the street trees are protected from injury by the caterpillars, and the danger from caterpillar poisoning, at least from this source, is done away with for next season. This, it seemed, was all that could be done against the brown-tail moth.

With the gypsy moth it was decided to follow practically the same lines with regard to shade trees and private estates, and, in addition, to make a special effort to protect all roadside trees, whether in the centres of population or in the outlying country. The matter of prime importance in connection with the gypsy moth is to prevent its farther spread as the result of the dropping of caterpillars on vehicles. So long as the street trees in our badly infested cities and towns remain infested by the insect, just so long will the caterpillars spin down in May and June and be carried long distances by the agencies of traffic over the road. It is imperative, therefore, that street trees and roadsides most

frequented for travel shall be kept free from the moth pest, and this has been the first effort of the present administration. In the central infested cities and towns a strong effort has been made to clear the street trees of the gypsy moth egg clusters, and in outlying districts wherever infestations occurred by roadsides the brush has been cut and burned and the trees remaining thoroughly treated. So long as roadside brush remains infested by the gypsy moth, just so long will it be practically impossible to keep the street trees free from these insects. The superintendent regrets that in carrying out this work it will be necessary to sacrifice for a time a considerable amount of roadside shrubbery, yet if this shrubbery is left in its present infested condition it will be killed in a few years by the moths. By cutting and burning it now, the shade trees will be protected, their continued infestation prevented and the moth pest destroyed. After these roadsides become free from the moth, nature in a few years will restore them to their former condition.

Many cases have arisen where badly infested woodland adjoins roadsides, and in the spring months yields large swarms of caterpillars to be carried away by every passing vehicle. In such cases an effort has been made to thin out such woodland and treat the moth nests along the road borders so as to establish a zone of safety from 50 to 100 feet wide, and thus do away with farther scattering of the insect. In the town of Saugus, for example, several woodland colonies abut on the public highways. From trees which overhang the road the caterpillars drop on passing vehicles. It is practically impossible to keep the central residential districts of Saugus free from the moth while these colonies exist, to say nothing of the adjoining towns of Wakefield, Lynnfield, Lynn, Revere, Malden and Melrose. In the case of these woodland colonies we have deemed it advisable to establish protective belts as above mentioned without reference to the action of the owners of the infested estates, who later on will be called upon to carry out the provisions of the act on the remaining untreated property.

The act under which work against the moth pests is be-

ing conducted requires the superintendent to “separate, so far as is practicable, the expenditures on work against the gypsy moth and those on work against the brown-tail moth in each city and town.” Since the law does not give the superintendent control over the form in which reports from cities and towns shall be rendered, it has been impossible to make such division of expenditures. Repeated letters have been sent to city and town treasurers and to the local superintendents in charge of the work, but it has been practically impossible to obtain the information desired.

FINANCIAL STATEMENT.

The law requires the superintendent to present his annual report “on or before the third Wednesday in January of each year.” It has been impossible to obtain from several cities and towns the complete record of their expenses under the act. The following report includes the records of the expenditures for work performed previous to Jan. 1, 1906. The balance of the appropriation is apparent rather than real, and will be practically expended during the month of January in additional reimbursements to those towns whose records as yet are incomplete.

Appropriation May 8, 1905,		\$75,000 00
Office expenses:—		
Management,	\$3,125 00	
Salaries of clerks,	1,292 00	
Rent,	516 67	
Stationery and postage,	913 34	
Printing,	951 91	
Supplies, furniture, etc,	545 30	
Expert advice,	167 85	
Sundries,	775 86	
Field expenses:—		
Wages of employees,	9,130 24	
Travelling expenses (superintendent and employees),	2,544 44	
Supplies,	149 46	
Reimbursement to cities and towns,	40,250 08	
Sundries,	113 50	
		<hr/>
		60,475 65
Balance Jan. 1, 1906,		<hr/>
		\$14,524 35

Parasite Appropriation.

The various expenses incurred in the work of importing and studying parasites of the gypsy and brown-tail moths are given below : —

Appropriation May 8, 1905,	\$10,000 00
Services of experts and collectors,	\$852 88
Wages of employees,	745 39
Travelling expenses,	116 08
Rent,	85 00
Supplies,	122 25
Stationery and postage,	13 04
Sundries,	170 45
	<hr/>
	2,105 09
Balance Jan. 1, 1906,	\$7,894 91

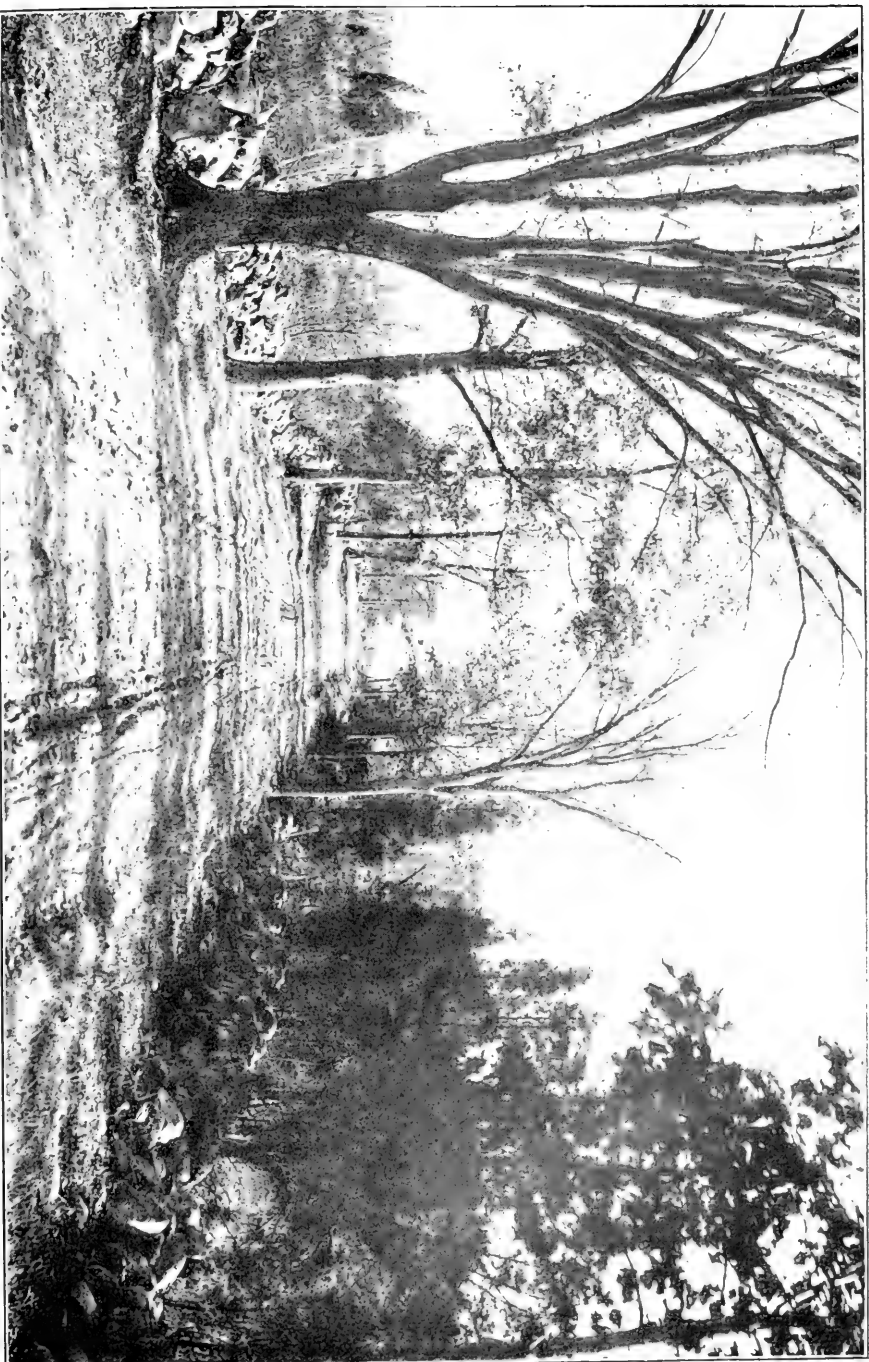
The total amount spent in the 22 cities and towns receiving reimbursement to the amount of \$40,250.08 may be distributed as follows : —

Total amount spent,	\$76,811 76
Pay-rolls,	\$65,944 08
Travelling expenses,	490 55
Supplies,	8,655 87
Sundries,	1,020 42
Stationery and postage,	483 37
Printing,	185 47
Rent,	32 00
	<hr/>
	\$76,811 76

As in the case of the central office, many expenses have been incurred this year by cities and towns which will not be duplicated in succeeding years. The items of “supplies” and “sundries” represent chiefly the investment in the necessary apparatus for conducting the work. Ladders, pruners, axes, spraying outfits, etc., have been required, and these supplies, even after a proper allowance for depreciation, will be available for use for several years to come.

CONDITION OF THE INFESTED DISTRICT.

In describing the infested district, a natural division includes the central and the outer towns and cities. By the “central towns” are meant those comprising the centre of



Roadside at Belmont, cleared of badly infested brush, and in condition for economical treatment.

infestation, and naturally the ones most thoroughly infested by the gypsy and brown-tail moths. The term "outer towns" includes those lying outside of this central badly infested district.

The degree of infestation varies in these latter towns from those which are generally infested lying on the border of the central district to the outer towns, such as Carlisle, Southborough, Hopkinton, Stoughton, etc., where only a few gypsy moth nests have been found. In each case the report is based upon an examination by an inspector from this office, supplemented by data furnished by the local superintendent.

The annual initial expenditure required to insure reimbursement by the State, both in 1905 and 1906, is given in the case of each municipality.

Central Towns.

ARLINGTON.

WALTER R. CASWELL, *Local Superintendent.*

1905, amount required before reimbursement,	. . .	\$1,978 25
1906, amount required before reimbursement,	. . .	3,956 49
1905, amount expended in work against moths,	. . .	10,484 57
1905, amount of State reimbursement,	. . . . .	-

This town is now as seriously infested as any in the district. The gypsy and brown-tail moths can be found through practically the entire area, while the woodland colonies are of notable size and importance. A great deal of good work has been done here by the local authorities in past years, but, in spite of this, the moths have gained rapidly in number. Spraying operations were carried on by the tree warden in certain badly infested sections, and early in July the present local superintendent was appointed, since which time the work has been pushed vigorously and in a very satisfactory manner. The trees on the main streets were burlapped and attended, and a large amount of clearing has been done in the Menotomy Rocks Park. The brush has been cleared from the infested roadsides and the street trees throughout the town have been cleaned of both species of the moths.

The town officials and leading property owners have shown a strong desire to co-operate with the local work in every

way. The town has already made a liberal provision for the work in 1906, which will include a campaign of burlapping, spraying, banding and fall cleaning. From the large amount of traffic which finds its way through Arlington the condition of the town is of serious importance to the surrounding country, and every effort will be made to bring the pests under control here at the earliest possible moment.

BELMONT.

F. D. CHANT, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,105 21
1906, amount required before reimbursement, . . .	2,210 42
1905, amount expended in work against moths, . . .	4,396 51
1905, amount of State reimbursement,	3,291 30

While much good work has been done on private estates and on town trees in recent years, the woodland colonies in Belmont have increased to formidable proportions. The work of the past season has been handled by a contractor, and has consisted of spraying, burlapping, fall cleaning of trees and cutting brush along infested roadsides and on other town property. Aside from the woodland colonies this town is now in condition where thorough-going measures can be employed to great advantage. It is hoped that at least a part of the infested woodlands may receive attention before next spring.

There has been in evidence a very general desire on the part of the citizens to co-operate with the town officials in clearing the moths from their own estates.

BEVERLY.

FRANK W. HAMMOND, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,500 00
1906, amount required before reimbursement, . . .	5,000 00
1905, amount expended in work against moths, estimated, .	3,500 00
1905, amount of State reimbursement,	-

Beverly is generally infested by the gypsy moth, in spite of the good work done by the local improvement association and numerous public-spirited individuals. The city is much in favor as a summer resort, and there is a great amount of

pleasure driving through it in the caterpillar season. The work on street trees has been prosecuted with vigor, and at the present writing about three-fourths of them have been cleared of both species of moths. In badly infested sections the roadside brush has been cut and the trees put in condition for burlapping next season. The most disquieting feature in the situation is the general infestation of the woodland. There is in this city a large area of fine woodland in which there are many old-growth trees. Since the gypsy moth has now established itself so generally in the woodland, a great deal of thorough work will be necessary to keep it under control. The work of next season should include burlapping the street trees of the entire city and spraying in the badly infested sections.

The people of Beverly have shown a most commendable public spirit and have co-operated fully with the State superintendent.

BOSTON.

WILLIAM DOOGUE and J. A. PETTIGREW, *Local Superintendents.*

1905, amount required before reimbursement, . . .	\$2,500 00
1906, amount required before reimbursement, . . .	5,000 00
1905, amount expended in work against moths, . . .	4,798 56
1905, amount of State reimbursement,	-

In the city of Boston the work of caring for the trees on streets and in the Public Garden, Common and public squares has been carried on by Superintendent of Public Grounds William Doogue, while the parks and boulevards have received the attention of Superintendent of Parks J. A. Pettigrew. The entire city may be said to be generally infested by both gypsy and brown-tail moths, the gypsy moth colonies at East Boston being of dangerous size. In the old gypsy moth colonies at Sargent Street, Dorchester, and Franklin Park, which were so thoroughly treated by the employees of the State Board of Agriculture, but few moths have been found. In recent years a great deal of work against the moths has been done by the city authorities, and, to some extent, by owners of private estates; but so many estates have been neglected that the insects have become thoroughly established and widely scattered. The Fenway,

with its great masses of beautiful shrubbery, is badly infested with the gypsy moth and should be sprayed next season. At East Boston and Orient Heights the situation is even more serious. Unless very thorough work is done here before the hatching period, a great deal of damage will be caused by the gypsy moth caterpillars. Throughout the entire city the brown-tail moth is present in large numbers.

The principal danger in the situation in Boston is the general infestation of private estates, and the apathy both of resident and non-resident property owners. A vigorous enforcement of the law will be necessary in order to keep the moths under control. So long as the private estates remain badly infested, so long will the efficient work of the city departments be undone each year, with consequent increasing expense to the taxpayers. If the moths are to be controlled in Boston, it is absolutely necessary not only that the law be vigorously enforced against owners of neglected estates, but also that next season a large amount of bur-lapping and spraying be done. A thorough inspection of the city is now in progress, and will be completed before the caterpillar season of next year.

BROOKLINE.

USIP PERRIN, *Local Superintendent.*

1905, amount required before reimbursement,	.	.	.	\$2,500	00
1906, amount required before reimbursement,	.	.	.	5,000	00
1905, amount expended in work against moths,	.	.	.	919	48
1905, amount of State reimbursement,	.	.	.	.	-

Brookline is now generally infested by both species of moths, but, thanks to the efficient work done in recent years by the local authorities and by private citizens, the insects have been kept well under control.

The citizens have shown a most gratifying disposition to spare no effort to suppress the moths, and as a result no serious damage by them has taken place. Since the egg-laying season a considerable gang of men has been employed in clearing the street trees of the gypsy moth, and at the present time work against the brown-tail moth is also under way. A considerable amount of bur-lapping will be necessary here next season.

BURLINGTON.

WALTER W. SKELTON, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$114 49
1906, amount required before reimbursement, . . .	228 98
1905, amount expended in work against moths, . . .	1,628 14
1905, amount of State reimbursement, . . .	1,513 65

Burlington may now be placed in the same category with the towns of the central infested district. In the southern part of the town remarkably large gypsy moth colonies exist in woodlands, and numerous estates are very badly infested. In one section the gypsy moth caterpillars stripped in the summer of 1905 some 20 acres of woodland, and street trees, orchards and even garden produce were injured and in some cases destroyed by them.

The local work against the moths is well organized and is being carried out in a satisfactory manner. The town officials and citizens generally have supported the efforts of the local superintendent, and satisfactory results should be in evidence next season when a considerable amount of bur-lapping, spraying and burning out of infested roadsides will be necessary. The brown-tail moth is generally distributed throughout the town and but little has yet been done against this insect.

The principal operations to date in Burlington have been on the large woodland colony in the southern part of the town where the orchards and woodlot have been thoroughly cleared of gypsy moth egg clusters up to the probable snow line. The underbrush, decayed trees, etc., have been removed, and the work of destroying the remainder of the nests is now under way. In the vicinity of this colony the infested roadsides have also been cleared of the brush and put in proper condition for bur-lapping.

CAMBRIDGE.

JAMES A. MONTGOMERY, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,500 00
1906, amount required before reimbursement, . . .	5,000 00
1905, amount expended in work against moths, . . .	6,900 63
1905, amount of State reimbursement, . . .	—

Since the cessation of the former State work this city has made liberal expenditures in an effort to control both species of the moths. From the facts that several electric car lines centre here, and that an immense amount of travel reaches Cambridge during the caterpillar season, the city is peculiarly exposed to infestation from outside sources. A fairly thorough inspection shows the gypsy moth scattered throughout the entire city, while important colonies exist in the section west of Harvard Square. A considerable amount of spraying was done here during the caterpillar season with good results, and at this writing the gypsy and brown-tail moth nests have been destroyed on the street trees practically throughout the entire city. About 60 men are now engaged in enforcing the law by clearing the moths from private estates.

The work in Cambridge has been carried on in a satisfactory manner, but much remains to be done during the coming season. The trees throughout the entire city should be burlapped and carefully attended, while spraying will be necessary in the worst infested sections. If the local authorities continue to co-operate as freely with the State superintendent in the future as they have in the past, there should be no unusual difficulties in controlling the moth pests in this city.

CHELSEA.

ALFRED L. MAGGI, *Local Superintendent.*

1905, amount required before reimbursement,	.	.	.	\$2,500 00
1906, amount required before reimbursement,	.	.	.	5,000 00
1905, amount expended in work against moths,	.	.	.	1,806 59
1905, amount of State reimbursement,	.	.	.	-

In Chelsea during the caterpillar season spraying was carried out in certain sections infested by the gypsy moth. The fall examination shows the city to be generally infested with both brown-tail and gypsy moths. In the sections near the Everett and Revere lines the gypsy moth occurs in large numbers. On Garden and Parker streets and in the Union Park section also numerous gypsy moth nests were found. Chelsea is fortunate, from the standpoint of our work, in possessing no woodland.

The local work has been well supported by the city authorities and has been carried out in a very efficient manner. At the present time about two-thirds of the trees on public streets have been cleared of the gypsy moth, and the brown-tail moth nests will have attention during January and February, 1906.

DANVERS.

THOMAS E. TINSLEY, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,069 75
1906, amount required before reimbursement, . . .	2,139 51
1905, amount expended in work against moths, . . .	2,248 60
1905, amount of State reimbursement, . . .	1,178 85

Danvers belongs in the generally infested class of towns. The gypsy moth is found in varying numbers throughout the entire town, and large colonies exist in Danversport and on Burley Street near the Wenham line. The residential section is generally infested. This district was burlapped and looked after with good results during the caterpillar season. About three-fourths of the street trees have been cleared of both brown-tail and gypsy moths, and the work is being prosecuted in a satisfactory manner. In certain seriously infested sections the roadside brush has been cut, but more of this work will be necessary before the gypsy moth can be brought under control. Owing to the general infestation of the town by both insects a large amount of work will be necessary here the coming year. The street trees should be burlapped, and a considerable amount of spraying will be necessary in the badly infested sections.

ESSEX.

T. B. FULLER, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$209 80
1906, amount required before reimbursement, . . .	419 61
1905, amount expended in work against moths, . . .	773 15
1905, amount of State reimbursement, . . .	-

Essex is generally infested by the gypsy moth, egg clusters having been found on nearly every estate so far examined. Between this town and Manchester there is a large wooded area containing a great deal of valuable pine timber.

In this section, so far as our inspections have gone, scattered egg clusters have been found. The local superintendent has taken much interest in prosecuting the work, and has thinned out in an excellent manner the badly infested roadsides, and has destroyed the gypsy and brown-tail moth nests on the street trees over nearly the entire town. The trees in the sections infested with the gypsy moth should be burlapped and receive careful attention next season. If this work is properly carried out, the gypsy moth should be brought under control at the close of the season. The brown-tail moth in this town is much less abundant than in some other Essex County towns.

EVERETT.

WILLIAM KENNERLY, *Local Superintendent.*

1905, amount required before reimbursement,	.	.	.	\$2,500 00
1906, amount required before reimbursement,	.	.	.	5,000 00
1905, amount expended in work against moths,	.	.	.	490 20
1905, amount of State reimbursement,	.	.	.	-

A general inspection of Everett during the caterpillar season showed the gypsy moth to exist in considerable numbers over the entire city. The matter was brought to the attention of the city authorities, but there was an unfortunate delay in appropriating money and commencing the work. Finally, about December 1, the city work was organized and operations were begun in the Mount Washington district. At the present writing about one-third of the street trees have been cleared of both species of moths.

The excellent work done in the Woodlawn Cemetery by the authorities in charge is worthy of particular mention. This work has not only protected the beautiful grove of trees existing there, but also, to a considerable extent, has prevented the spreading of the moths outward into adjoining territory.

The brown-tail moth is present over the entire city, being most numerous on private estates. It is expected that the work on street trees will be completed by February 1, when the enforcement of the law on private estates will have attention. The operations of next season should include a liberal

campaign of burlapping, spraying and fall cleaning of the trees. If this can be done, there are no particular difficulties in the way of controlling the gypsy moth in Everett.

GLOUCESTER.

W. D. CORLISS, *Local Superintendent.*

1905, amount required before reimbursement,	. . .	\$2,500 00
1906, amount required before reimbursement,	. . .	5,000 00
1905, amount expended in work against moths,	. . .	2,171 32
1905, amount of State reimbursement,	. . . . .	-

Gloucester has been thoroughly scouted by Inspector C. E. Merrill, who found the gypsy moth scattered throughout the entire city. The woodland is generally infested, and a great deal of careful work will be required to control the moth there. The residential section also is generally infested. Owing to the immense amount of summer travel between Gloucester and the surrounding country there is great danger of distribution of the moth from the city.

The city work against both brown-tail and gypsy moths began October 28 and has been carried on in a very satisfactory manner. At this writing practically all the trees on streets and public grounds have been cleared of both species. It is important that the trees throughout the entire city be burlapped another season in order to bring the gypsy moth under control at the earliest possible moment. The residential parts of the city are thoroughly infested with the brown-tail moth, and some spraying against the pest may be required next summer.

LEXINGTON.

CORNELIUS WELLINGTON, *Local Superintendent.*

1905, amount required before reimbursement,	. . .	\$1,165 46
1906, amount required before reimbursement,	. . .	2,330 92
1905, amount expended in work against moths,	. . .	3,990 52
1905, amount of State reimbursement,	. . . . .	2,825 06

Lexington is generally and thoroughly infested by both species of moths, but in recent years has had the advantage of a great deal of work on the part of the tree warden and his assistants. The residential section is infested by the gypsy moth in scattering numbers, while certain woodland

colonies have reached formidable proportions. During the summer the trees along the main streets were burlapped, and a limited amount of spraying was done. Throughout the southern half of the town the roadside brush has been cut and the work of clearing the street trees of the moth pests is under way.

The town officials have supported the work in a very satisfactory manner and the actual field operations have been thoroughly and economically performed. The trees in the sections infested by the gypsy moth should be burlapped next season and spraying also will be necessary in certain localities. It is important that the woodland problem be taken up in this town as soon as possible as it is practically impossible to keep the street trees free from the moth while large colonies exist in the woods.

LYNN.

NATHAN M. HAWKES, *Local Superintendent.*

1905, amount required before reimbursement,	.	.	.	\$2,500 00
1906, amount required before reimbursement,	.	.	.	5,000 00
1905, amount expended in work against moths,	.	.	.	6,204 44
1905, amount of State reimbursement,	.	.	.	1,852 22

Lynn is generally infested with the gypsy moth, both in the woodland and the residential sections. The results of a thorough examination of the city by Inspector H. W. Vinton have been made known to the local authorities. The Lynn Woods Park, one of the largest of our suburban woodland reservations, is generally infested. The number of very serious colonies here is considerable. The land held by the water board in this section is also badly infested. So severe has been the attack of the gypsy moth caterpillars in past years that over 100 acres of trees have been killed on the northerly side of Glen Lewis Pond. During the caterpillar season the worst infested sections in the park were burlapped and attended, although this work would have been more effective if it had been possible to do it earlier in the season. About one-half of the street trees in the residential section were also burlapped and attended. In November a large gang was put at work thinning out the badly infested sections in the park. A great deal remains to be done here,

and a large expense will be necessary even to control the moth in the woodland. The residential parts of Lynn are thoroughly infested with the brown-tail moth.

LYNNFIELD.

HENRY LAW, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$147 28
1906, amount required before reimbursement, . . .	294 55
1905, amount expended in work against moths, . . .	1,777 74
1905, amount of State reimbursement, . . .	1,634 94

Lynnfield is unfortunate in having a very large area of badly infested woodland. Practically the entire southern half of the town is thoroughly infested by the gypsy moth. In past years the caterpillars have stripped large areas, and doubtless much scattering of the moth has taken place. During the past summer the street trees in the southern part of the town were burlapped and attended, and a large area of badly infested woodland was cut.

At the present time the local force is engaged in clearing from the street trees the nests of both brown-tail and gypsy moths; about one-third of the trees have been thus covered. Woodland colonies adjoining the main roads have been thinned out to a distance of about 50 feet from the highway and put in proper condition for burlapping. This work was necessary in order to prevent the scattering of the moths in the summer of 1906. A large woodland colony in the northern part of the town has been the cause of considerable anxiety to both the local and State authorities. An effort will be made to subject it to thorough treatment next season. The street trees throughout the town should be burlapped and a considerable amount of spraying will also be necessary. In the woodland sections which have been thinned out, the trees should be banded to prevent the ascent of caterpillars.

MALDEN.

THOMAS F. POWELL, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,500 00
1906, amount required before reimbursement, . . .	5,000 00
1905, amount expended in work against moths, . . .	4,782 71
1905, amount of State reimbursement, . . .	-

Upon request of the superintendent the city government of Malden in June, 1905, appropriated \$5,000 for work against the gypsy and brown-tail moths. The city, of course, is very generally infested by the gypsy moth; in fact, it may be considered as one of the worst infested places in the whole district.

In past years a great deal of good work has been done in Malden under the direction of Mr. George W. Stiles, superintendent of streets. A limited amount of banding of trees was carried out during the caterpillar season, and the results from spraying were particularly satisfactory.

As soon as the egg clusters were laid in 1905, the local superintendent started a gang of men at work treating the eggs on street trees from the ground to above the probable snow-line. The border of the infested woodland adjacent to the Fells Reservation of the metropolitan park system has been thinned out and placed in suitable condition for banding and spraying next year. The trees belonging to the city at Waite's Mount and in Forest Dale Cemetery have been thinned out and put in proper condition for next season's work. The local superintendent, in spite of many obstacles to thorough work, has accomplished most satisfactory results, and the property owners throughout the city have shown a spirit of co-operation. If all land owners will perform their obligations under the law with as much faithfulness as has the local superintendent, the gypsy moth in Malden will soon be brought under control. A great deal of spraying and burlapping will be necessary next season, and in the infested woodlands now thinned of dead and worthless trees banding with some preparation to prevent the ascent of caterpillars should be done.

MANCHESTER.

ROBERT A. MITCHELL, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,030 05
1906, amount required before reimbursement, . . .	4,060 10
1905, amount expended in work against moths, . . .	1,121 57
1905, amount of State reimbursement,	-

The gypsy moth occurs throughout this town, and the brown-tail moth is plentiful. In the central residential

sections the gypsy moth infestation is now of alarming extent, and the insect is scattered in small numbers in other parts of the town. No thorough inspection as yet has been made of the woodland, but gypsy moth nests have been found along the road leading to Essex. In the northern part of the town there is a large tract of fine old-growth trees which is infested in places. An effort will be made in the near future to inspect thoroughly all the woodland in Manchester.

The local superintendent has destroyed the gypsy and brown-tail moth nests on town trees over about three-fourths of the town, and this work has been carried on in a very satisfactory manner. The trees in the central district should be burlapped and carefully attended next summer. There are several small orchards which are badly infested by the gypsy moth, and these should be sprayed at the proper season.

MARBLEHEAD.

N. ALLEN LINDSEY, *Local Superintendent.*

1905, amount required before reimbursement,	.	.	.	\$1,420	26
1906, amount required before reimbursement,	.	.	.	2,840	52
1905, amount expended in work against moths,	.	.	.	2,829	99
1905, amount of State reimbursement,	.	.	.	1,127	78

The gypsy moth occurs generally throughout this town, the worst infested sections being in the central residential district. A great deal of good work has been done here in past years under the direction of the tree warden, supplemented by the efforts of an effective local improvement association. During the caterpillar season of 1905 the street trees were burlapped in the worst infested sections. Later, the infested roadsides were cut out and burned over. The destruction of the gypsy and brown-tail moth nests on street trees has been completed and a considerable amount of work accomplished by the owners of private estates. Practically all this work has been done by a contractor under the direction of the local superintendent. The trees throughout the entire town should be burlapped next spring; spraying will be necessary in certain sections.

MEDFORD.

JOHN D. DWYER, *Local Superintendent.*

1905, amount required before reimbursement,	. . .	\$2,500 00
1906, amount required before reimbursement,	. . .	5,000 00
1905, amount expended in work against moths,	. . .	12,684 89
1905, amount of State reimbursement,	. . .	5,092 45

Medford, the original centre of gypsy moth infestation, as might be expected is thoroughly infested by the insect. The city offers one of the most difficult problems in moth control in the whole district. The entire residential section is thoroughly infested, and the large colonies in the woodland in the northern part of the city annually yield swarms of caterpillars to reinfest estates and street trees previously cleared of the moth.

Gen. S. C. Lawrence, the largest owner of woodland in the city, has for years waged a most vigorous campaign against the gypsy moth, and his efforts along this line cannot be too highly commended. He has not only succeeded in controlling the pest on his own woodland, but, at a large expense, has suppressed it also on many private estates.

The city work against the gypsy moth has been vigorously carried on under the local superintendent. During the caterpillar season an effort was made to destroy as many caterpillars as was possible under the burlaps and bands on street trees. Following this, as soon as the eggs were laid, vigorous efforts were made to clear the street trees, and at this writing nearly all those on streets and in public squares have been cleared of brown-tail as well as gypsy moths. What is more important, the badly infested woodland area in the northerly part of the city has been thinned and put in condition for burlapping and spraying next season.

A large amount of money must be spent in 1906 in banding trees in the infested woodlands, in burlapping street trees and in spraying. The city is so thoroughly infested with the gypsy moth that a vigorous enforcement of effective measures and the hearty co-operation of all citizens will be required to bring the pest under control.

MELROSE.

JOHN J. McCULLOUGH, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,500 00
1906, amount required before reimbursement, . . .	5,000 00
1905, amount expended in work against moths, . . .	6,945 29
1905, amount of State reimbursement, . . .	2,222 65

This city is thoroughly infested over its whole area. The Pine Banks Park is now thoroughly infested and over 200 large white pines have been destroyed by the moths. In the eastern section of this park the local superintendent has thinned out the remaining deciduous trees, and the whole territory now is in proper condition for banding and spraying. This park is held in joint ownership by the cities of Malden and Melrose, and the actual operations against the moths here have been under the general direction of Mr. David F. Roy, who has urged that this work be prosecuted with the utmost vigor and thoroughness. Over one-half of the street trees of Melrose have been cleared from the moth, and plans are now under way for a vigorous enforcement of the law against the owners of private estates. Next season a great deal of burlapping, banding and spraying will be necessary in this city, and infested roadsides and walls should be burned out. If the work in this city in 1906 can be carried on with as much energy as in the past year, satisfactory results will be obtained.

NAHANT.

THOMAS J. DEVENEY, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,064 15
1906, amount required before reimbursement, . . .	2,128 29
1905, amount expended in work against moths, . . .	230 00
1905, amount of State reimbursement, . . .	-

Nahant has received very careful attention in past years from the tree warden, Mr. George Abbot James, and as a result is in much better condition than many of the neighboring towns. The gypsy moth has been found scattered throughout the town, and the brown-tail moth is present in

large numbers. The street trees were sprayed early in the caterpillar season with good results.

The United States reservation near Bass Point has become generally infested, and its condition has caused a great deal of complaint on the part of neighboring property owners. As a result of Mr. James's efforts the reservation is now being thoroughly cleared of the moths.

The street trees of the entire town should be burlapped next season and sprayed if funds permit.

NEWTON.

CHARLES W. ROSS, *Local Superintendent.*

1905, amount required before reimbursement,	. . .	\$2,500 00
1906, amount required before reimbursement,	. . .	5,000 00
1905, amount expended in work against moths,	. . .	1,231 36
1905, amount of State reimbursement,	. . . . .	-

Newton has been infested by the gypsy moth since 1899. Throughout the city the insect now occurs in scattering numbers, and there are some colonies of considerable size which require most thorough treatment. The brown-tail moth is also scattered in average numbers over the entire city, being most plentiful in the eastern section.

For many years past the trees of this city have had the advantage of competent supervision, and this work has received adequate financial support at all times. As a result, the condition of Newton is much better than would have been the case had a policy of neglect been adopted. During the past summer and fall the local superintendent has prosecuted the necessary work with vigor and to our complete satisfaction. If the moths are to be held in check, however, a considerably increased expense must be made next year in the way of burlapping, spraying and fall cleaning of trees.

PEABODY.

JAMES F. CALLAHAN, *Local Superintendent.*

1905, amount required before reimbursement,	. . .	\$1,748 97
1906, amount required before reimbursement,	. . .	3,497 94
1905, amount expended in work against moths,	. . .	5,253 54
1905, amount of State reimbursement,	. . . . .	2,803 66

Peabody is seriously infested by the gypsy moth, and the brown-tail moth also occurs in large numbers. Gypsy moth colonies have been found scattered throughout the woodlands, and unless suppressed will soon increase to formidable proportions. The badly infested roadsides throughout the town have been cut out and the brush burned. During the caterpillar season a large number of trees were banded and attended by the local force. At the present time the work of destroying both gypsy and brown-tail moth nests on the street trees is being prosecuted vigorously, and nearly one-half of these have been cleared of the insects.

The work in this town has been well planned, has had excellent supervision and has given satisfactory results. All the trees on streets should be burlapped next season, and spraying will be necessary in the worst infested sections.

QUINCY.

THOMAS F. BURKE, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,500 00
1906, amount required before reimbursement, . . .	5,000 00
1905, amount expended in work against moths, estimated, .	1,023 97
1905, amount of State reimbursement,	-

The infestations in Quincy are of particular importance because of the immense amount of travel passing through the city to South Shore points. There can be no question that the general infestation of the central residential district at Quincy has been the cause of many of the gypsy moth colonies found along the South Shore. The city is generally infested with the gypsy moth, and several colonies have reached a point where injury to the trees will take place next year unless thorough measures are applied.

The local work has been well organized and prosecuted vigorously. At this writing the work against the gypsy moth has been completed on the street trees, and plans are under way for a vigorous campaign against the brown-tail moth. The most serious feature of the local situation is the general and often severe infestation of private estates by the gypsy moth. On these places a great many egg clusters have been broken and scattered, and it is probable that con-

siderable injury to trees will be evident during the caterpillar season of next year. The street trees of the entire city should be burlapped, and spraying may be necessary in certain seriously infested localities.

READING.

GEORGE F. SAWYER, *Local Superintendent.*

1905, amount required before reimbursement,	.	.	.	\$922 69
1906, amount required before reimbursement,	.	.	.	1,845 37
1905, amount expended in work against moths,	.	.	.	2,310 60
1905, amount of State reimbursement,	.	.	.	1,387 91

Reading is generally infested by the gypsy and the brown-tail moths, in spite of the considerable amount of efficient work done in recent years by the local authorities and private citizens. The most serious feature of the situation is the general infestation of certain woodland areas in the southern part of the town. During the caterpillar season the trees in the centre of the town and along the main streets were burlapped and attended, with the result that a large number of gypsy moth caterpillars were destroyed. The work here has been placed in competent hands, has been carried on in a very satisfactory manner and has been liberally supported by the town authorities. The attitude of private citizens also is all that could be desired.

At the present writing the street trees throughout at least one-half the town have been cleared of the nests of both species of moths, and the infested roadsides throughout the entire area have been cut over and burned, thus reducing the cost of the work next year. In 1906 the trees throughout the entire southern half of the town and along the main streets should be burlapped, and a considerable amount of spraying will be necessary. In certain sections the roadsides will require burning over with oil.

REVERE.

JAMES W. BOND, *Local Superintendent.*

1905, amount required before reimbursement,	.	.	.	\$2,439 45
1906, amount required before reimbursement,	.	.	.	4,878 89
1905, amount expended in work against moths,	.	.	.	3,994 77
1905, amount of State reimbursement,	.	.	.	1,244 26

While Revere does not possess any large woodland areas, it is generally and thoroughly infested with both species of moths. Revere is the centre of a tremendous amount of summer travel to the shore reservation; it is particularly exposed to infestation from outlying districts, while, on the other hand, there is great danger that the caterpillars may be carried from the town and distributed over a wide area.

The town has made suitable provision for the necessary work against the moths, but this has not been carried out in a manner satisfactory to this office. It is apparent that considerations foreign to the interests of the work have seriously interfered with the efforts to suppress the moths. The conditions prevailing in this town well illustrate the folly of attempting to combat, under local auspices, the moth nuisance, unless this important work can be treated as a business proposition and carried on with a single purpose in view. The amount of funds which any city or town can be asked to appropriate for work against the moths is limited, and the assistance available from the State appropriation under present conditions is but small; hence, there is all the more reason why city, town and State officials and private citizens should co-operate heartily in this work, with a common purpose and for a common end.

At the present writing the work in Revere is in an unfinished state. The gypsy moth egg clusters have been cleared from nearly all the street trees, but little work has been done against the brown-tail moth, either on public trees or private estates, while there exist many miles of badly infested roadsides where brush should be cut and burned during the winter.

The street trees should be burlapped and sprayed next season, and a vigorous inspection maintained over private estates. This work, however, will be of but little value unless it can be carried on in an efficient manner and kept free from the influence of local politics.

SALEM.

AMOS STILLMAN, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,500 00
1906, amount required before reimbursement, . . .	5,000 00
1905, amount expended in work against moths, . . .	5,602 22
1905, amount of State reimbursement,	-

The city of Salem is thoroughly and generally infested by the gypsy moth, and the brown-tail moth also occurs in large numbers. In recent years the city has made liberal appropriations for suppressing the moths, and has shown a most commendable spirit in endeavoring to check their increase on street trees and on private estates. Over \$8,000 was expended in this way in 1905, previous to the passage of the present act.

During November and December the local superintendent has had a large gang of men clearing the street trees of both species of moths. This work has been carried on in an efficient manner and should show good results next season. At this writing about one-half the street trees of the city have been cleared, and practically all the infested roadsides have been cut out. The street trees throughout the entire city should be burlapped and carefully attended next season, and the woodland colonies thinned out and thoroughly sprayed. The problem of suppressing the moths in Salem is a most serious one, and constant effort and the expenditure of a large amount of money for some years to come will be necessary to keep them under control.

SAUGUS.

WILLIAM A. HATCH, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$866 77
1906, amount required before reimbursement, . . .	1,733 54
1905, amount expended in work against moths, . . .	8,922 25
1905, amount of State reimbursement,	8,055 48

Saugus is generally and severely infested by both gypsy and brown-tail moths. Practically all the woodland is infested by the gypsy moth in dangerous numbers, and during

the caterpillar season of 1905 a great deal of stripping took place.

The town has shown a most helpful and commendable interest in suppressing the gypsy moth. Town work was begun promptly in May, upon the passage of the present act, and has been prosecuted with vigor and with most satisfactory results. The work has been under the supervision of a thoroughly trained man and the results have been most gratifying. During the caterpillar season a large part of the street trees were burlapped and sprayed; and as soon as the eggs were laid, a gang of men was put at work destroying them. At this writing the street trees throughout the town have been cleared of the gypsy moth egg clusters, and nearly all the necessary work against the brown-tail moth has been performed. The infested roadsides have been thinned out over approximately one-half the town. Certain owners of valuable woodland who have shown a disposition to make a liberal expenditure for suppressing the moths have received the assistance of the town force. About 200 acres of badly infested woodland have been thinned out and put in condition for next season's work. Saugus presents one of the most serious problems in the entire district. A great deal of burlapping and spraying and other necessary work must be done next season if the increase of the moths is to be checked.

SOMERVILLE.

CHARLES I. BUCKNAM, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,500 00
1906, amount required before reimbursement, . . .	5,000 00
1905, amount expended in work against moths, estimated, . .	1,100 00
1905, amount of State reimbursement,	-

The city of Somerville is entitled to highest praise for the very thorough and efficient work performed against the brown-tail and gypsy moths since the cessation of exterminative work by the State in 1900. This work has been in the hands of the inspector of trees, a man thoroughly competent to judge of the needs of the situation, who fortunately has been liberally supported by appropriations

from the city government. As a result, the infestations in this city by either brown-tail or gypsy moth are limited in number, and principally confined to certain areas of land which have been held for building purposes and which have received no attention from the owners. The gypsy moth is scattered to-day in small numbers throughout the city, the principal infestations being in the western section. The brown-tail moth is generally prevalent, but in small numbers. The occurrence of this insect (and frequently also of the gypsy moth) in Somerville without doubt arises from the numerous neglected estates in neighboring cities. At the present writing the work of clearing both moths from the street trees is nearly completed. A considerable amount of burlapping will be required next season in the sections where the gypsy moth still exists.

STONEHAM.

GEORGE M. JEFTS, *Local Superintendent.*

1905, amount required before reimbursement,	. . .	\$980 84
1906, amount required before reimbursement,	. . .	1,961 68
1905, amount expended in work against moths,	. . .	3,193 99
1905, amount of State reimbursement,	. . .	640 45

Stoneham, with its large woodland areas, is thoroughly infested by both species of moths. The gypsy moth is abundant in dangerous numbers in the woodland in the southern part of the town, and roadsides and orchards are generally infested.

The work against the moths in this town is entitled to high commendation. It was placed last summer in the hands of a competent trained man, and has been liberally supported by appropriation of town funds. At the present writing the infested roadsides in all parts of the town have been cut over and burned and the street trees and those on public grounds have been cleared of gypsy moth egg clusters. Work against the brown-tail moth is now in progress and should be completed by February 1. Perhaps because this town has been so severely afflicted by both moths, the property owners are showing a most commendable interest in destroying decayed or worthless trees and brush, and in

clearing the moths from the remaining trees on their estates. Next season the trees throughout the town should be burlapped, and a considerable amount of spraying also will be necessary.

SWAMPSCOTT.

GEORGE NEWHALL, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,539 06
1906, amount required before reimbursement, . . .	3,078 12
1905, amount expended in work against moths, . . .	2,624 14
1905, amount of State reimbursement, . . .	-

Swampscott is badly infested by both species of moths. The gypsy moth colonies in the westerly part of the town are of large size. In the woodland in the easterly part there are numerous scattering gypsy moth egg clusters; but in the Cedar Hill section, where a large moth colony was treated a number of years ago by the employees of the State Board of Agriculture, only a few moths have been found.

Work against the caterpillars was begun by the local superintendent June 17, and a gang of men has been employed against the gypsy moth practically all the time since that date. The infested roadsides have been cut out and the remaining trees put in condition for burlapping next season. Nearly all the large infested pasture area has been cut out and should be burned early in the caterpillar season of next year. Practically all the work against both moths on street trees has been completed at this writing. Aside from burning over the infested pastures a great deal of burlapping and spraying will be necessary next season to bring the gypsy moth under control.

WAKEFIELD.

W. W. WHITTREDGE, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,669 12
1906, amount required before reimbursement, . . .	3,338 24
1905, amount expended in work against moths, . . .	3,881 74
1905, amount of State reimbursement, . . .	1,770 10

Wakefield is now generally infested over its entire area by both moths. The gypsy moth is most abundant in the southern and eastern parts of the town and it occurs in scattering numbers in the northern woodlands.

The local officials early made suitable provision for the town work, and the necessary operations were carried on during the summer and fall in a generally satisfactory manner. The street trees in the central district were burlapped and attended during the summer months, and a certain amount of fall spraying against the brown-tail moth gave good results. A part of the infested roadsides has been cut out and burned, but more of this work remains to be done. The town park at Hart's Hill has been cleared of dead and worthless trees, the brush cut and burned and the moth nests destroyed on the remaining trees. This particular work has been performed in a very thorough and satisfactory manner.

At the present time the local force is at work on street trees destroying the nests of both moths, and will probably be able to take up work on private estates by February 1. The work next season will include a general campaign of burlapping and spraying, and roadsides in certain sections and in a part of the park reservation must be burned over with oil.

WALTHAM.

RICHARD A. JONES, *Local Superintendent.*

1905, amount required before reimbursement,	.	.	.	\$2,500 00
1906, amount required before reimbursement,	.	.	.	5,000 00
1905, amount expended in work against moths,	.	.	.	1,197 64
1905, amount of State reimbursement,	.	.	.	-

Waltham was practically clear of the gypsy moth at the close of the former State work; but a hasty inspection during the caterpillar season of 1905 revealed the presence of the insect over the entire area, although none of the colonies outside the woodland district were of notable size. In the woods lying near Lexington Street in the northern part of the city there is a large colony covering approximately 10 acres, over half of which was severely injured last summer by the caterpillars. The brown-tail moth is generally scattered throughout the city.

In past years considerable work was done by the city authorities against this insect, both on street trees and on private estates. During the past season the local work

against both species of moths was prosecuted with vigor and in a very satisfactory manner. In this city we have had the hearty co-operation of the mayor and city government, which has greatly favored the accomplishment of the necessary work. The street trees have been cleared of the gypsy moth egg clusters, and the work against the brown-tail moth is practically completed at this writing. The woodland colonies will have attention during the winter months, and an earnest effort will be made to put the whole city in condition for efficient work before the hatching period of the eggs next spring. The trees in the infested sections should be burlapped next season, and a limited amount of spraying will probably be necessary.

WATERTOWN.

FRANCIS H. BARNES, *Local Superintendent.*

1905, amount required before reimbursement,	. . .	\$2,431 91
1906, amount required before reimbursement,	. . .	4,863 82
1905, amount expended in work against moths,	. . .	4,099 24
1905, amount of State reimbursement,	. . .	1,333 86

Watertown is now generally infested by both species of moths, but is fortunate in the fact that it has so little woodland. The street trees and private estates are generally infested by both moths, the gypsy being particularly abundant in the eastern section of the town. During the fall months the infested roadsides were cleared of brush and undesirable trees, and at this writing about three-fourths of the street trees have been cleaned of the moths.

The local authorities have shown a disposition to provide suitable funds for the work, which has proceeded in a satisfactory manner. The most serious problem in the town is the large number of badly infested private estates, and the notable apathy of many citizens with reference to destroying the moths on their property. The trees throughout the entire town should be burlapped and sprayed next season. If thorough work can be continued here, the moths should be brought under control before the close of the caterpillar season of 1906.

WINCHESTER.

IRVING T. GUILD, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,058 73
1906, amount required before reimbursement, . . .	4,117 46
1905, amount expended in work against moths, . . .	3,379 16
1905, amount of State reimbursement,	-

In the residential part of Winchester a great deal of thorough work has been done in past years under the direction of the tree warden. While very satisfactory in view of the local conditions, this work has been seriously interfered with and often set at naught by the influx of gypsy moths from the surrounding woodland colonies. There have also been numerous cases of conspicuous neglect, even on the part of well-to-do private citizens, who have failed to clear their property of the moth pests. The woodland areas of the town are infested by the gypsy moth in dangerous numbers, while the brown-tail moth occurs in large numbers practically over the entire town. The section which adjoins Woburn is particularly infested with this insect.

The town began work promptly under the present act, and has prosecuted its campaign against the moths with a great deal of vigor. The work of the local superintendent is entitled to highest praise and has been well supported by the town authorities. A large expenditure of money must be made in this town, however, before the moths can be brought under control. A liberal amount of burlapping, banding and spraying will be necessary next season. At the present writing the necessary work on public trees has been practically completed, and a considerable amount of work has been done by private citizens in the badly infested woodlands. In co-operation with the city of Medford, the local force is now engaged in thinning out the badly infested section known as the Russell Woods, lying on the southern border of the town.

WINTHROP.

FRANK W. TUCKER, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,784 37
1906, amount required before reimbursement, . . .	3,568 74
1905, amount expended in work against moths, estimated, .	525 00
1905, amount of State reimbursement,	-

This town is now generally infested by both species of moths, although no particularly dangerous colonies exist. The town officials have provided suitable funds for the work, which has been carried out under the direction of an active and efficient committee. At this writing the trees on streets and in public parks have been cleared of both species of the moths, and the work on private estates has begun. Although Winthrop is small in area, it has about 1,000 street trees and nearly twenty-five miles of streets. The most important infestations by each moth are in certain small fruit orchards.

The work in the town has been done in a satisfactory manner, has been properly supported by the public, and if these conditions prevail through 1906, the results should be most satisfactory. Burlapping and a limited amount of spraying will be required next year.

WOBURN.

PETER E. McHUGH, *Local Superintendent.*

1905, amount required before reimbursement,	. . .	\$2,167 67
1906, amount required before reimbursement,	. . .	4,335 34
1905, amount expended in work against moths,	. . .	7,528 87
1905, amount of State reimbursement,	. . . . .	-

No city or town in the infested district is more in need of thorough and efficient work against the gypsy and brown-tail moths than is Woburn. Both insects occur generally throughout the city. The central residential district, the eastern section adjacent to Stoneham and Winchester and the woodlands in the southern and western parts are all badly infested by the gypsy moth. Large woodland colonies of the gypsy moth have now developed to alarming proportions.

During the caterpillar season a limited amount of spraying was done in the city, and with the approach of the time for fall work liberal financial provision was made by the city government. Unfortunately the business interests of the local superintendent prevented him from giving to the necessary operations proper supervision. There has been in evidence at all times in Woburn a most discouraging tendency to make the work a question rather of employing labor than of attempting to control the moths. Late in December, just

before the close of the fiscal year, a force of nearly 250 men was put at work. The few trained foremen available were simply unable to handle this large gang of men, and, although repeated complaints were made by the State agents to the officials in charge, practically no improvement in the condition was obtainable. It is safe to say that a gang of 25 men, properly directed and working throughout the season, would have accomplished much more in suppressing the moths than the poorly directed forces employed in 1905.

We have assurances that during the coming year the moth work in Woburn will be treated as a business proposition and carried out on business-like lines. If this is done, much relief from the pests should be obtained. If not so done the money expended will be practically squandered, and the condition of the city at the close of the year will be even worse than at present.

Nearly all the infested roadsides in the city have been cut out and about one-half of the street trees have been cleared of both moths, although a considerable amount of reinspect-ing will be necessary. The work of next season should include a vigorous campaign of spraying, burlapping and an effort to control, if funds permit, the increase of the moth in woodland colonies.

Outer Towns.

ABINGTON.

C. FRED SHAW, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$508 08
1906, amount required before reimbursement, . . .	1,016 16
1905, amount expended in work against moths, estimated, .	46 75
1905, amount of State reimbursement,	-

An examination of this town by inspectors from this office revealed the gypsy moth in 12 localities. The brown-tail moth is generally scattered throughout the town. The street trees have been cleared of both species of the moths, but as yet little work has been done on private estates. Burlap-ping will be necessary in the sections infested with the gypsy moth during the caterpillar season of 1906.

ACTON.

CHARLES J. WILLIAMS, *Local Superintendent.*

1905, amount required before reimbursement,	\$339 59
1906, amount required before reimbursement,	679 17
1905, amount expended in work against moths, estimated, .	150 00
1905, amount of State reimbursement,	-

A hasty inspection of the roadsides, street trees and orchards in this town revealed the presence of 4 small gypsy moth colonies, and the brown-tail moth was found generally distributed throughout the entire area. The local authorities have endeavored to co-operate fully with us in suppressing the insects, and the work has been carried on in a most satisfactory manner. At the present writing nearly all the street trees of the town have been cleared of both moths. The infestations here of the gypsy moth do not offer any serious difficulties if the present thorough work can be continued. Next season the trees in the sections where the colonies were found should be burlapped and carefully attended.

AMESBURY.

A. L. STOVER, *Local Superintendent.*

1905, amount required before reimbursement,	\$1,059 49
1906, amount required before reimbursement,	2,118 97
1905, amount expended in work against moths,	667 20
1905, amount of State reimbursement,	-

The gypsy moth is scattered throughout this town, but none of the colonies are of large size. The principal infestations are in the central residential district, although a few colonies have been found in the northern part of the town near the New Hampshire line. The brown-tail moth is remarkably abundant and last summer caused considerable damage to trees. The work against the moths has been prosecuted vigorously and to our complete satisfaction. The street trees have been cleared of both species of moths. These trees in the sections infested with the gypsy moth should be burlapped next season and carefully attended.

ANDOVER.

J. H. PLAYDON, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,221 62
1906, amount required before reimbursement, . . .	2,443 24
1905, amount expended in work against moths, estimated, .	1,010 00
1905, amount of State reimbursement,	-

About 50 estates infested by the gypsy moth have been located in Andover by our inspectors. The principal infestations are in the centre of the town and around the academy and seminary buildings. Small colonies have been found scattered in the southern, eastern and western portions of the town, and a general infestation by the brown-tail moth is in evidence. Much good work has been done here in the past by the tree warden, who has been properly supported in his efforts by an excellent public spirit on the part of citizens and town officials. At the present time about two-thirds of the street trees of the town have been cleared of the moths. A great deal of traffic passes through Andover, and the danger both of bringing in additional moths and of carrying others away from the infested localities is a serious feature of the situation. The street trees should be burlapped next season, and a considerable amount of spraying will be necessary.

ASHLAND.

F. A. MORSE, *Local Superintendent.*

1905, amount required before reimbursement,	\$203 33
1906, amount required before reimbursement,	406 65
1905, amount expended in work against moths, estimated, .	25 00
1905, amount of State reimbursement,	-

In Ashland the roadsides and orchards have been examined and 4 small gypsy moth colonies located. The brown-tail moth appears to be very scarce in the town. The town work has been organized and everything necessary to suppress the moths has been accomplished. Burlapping will be necessary next year in the sections infested with the gypsy moth, and a thorough watch should be kept for the development of any additional colonies.



Pines, Lebanon Street, Malden, stripped by gypsy moth caterpillars in 1904; dead in 1905.

AVON.

V. L. SNELL, *Local Superintendent.*

1905, amount required before reimbursement,	\$181 48
1906, amount required before reimbursement,	362 96
1905, amount expended in work against moths, estimated, .	15 00
1905, amount of State reimbursement,	-

Two small colonies of the gypsy moth have been found in this town and have been treated by Inspector Joseph Silva. The local superintendent has cleared the street trees of the brown-tail moth, and also has nearly completed the examination and treatment of private estates.

BARNSTABLE.

EBEN SMITH, *Local Superintendent.*

1905, amount required before reimbursement,	\$969 31
1906, amount required before reimbursement,	1,938 62
1905, amount expended in work against moths,	-
1905, amount of State reimbursement,	-

There are numerous brown-tail moth webs in evidence in this town, and these should be removed before spring. A preliminary inspection made late in December revealed the presence of 1 gypsy moth egg cluster in a tree near one of the largest hotels, a place much frequented by automobiles. The local work has been organized and will be under way early in January.

BEDFORD.

CHARLES W. JENKS, *Local Superintendent.*

1905, amount required before reimbursement,	\$242 04
1906, amount required before reimbursement,	484 08
1905, amount expended in work against moths,	131 92
1905, amount of State reimbursement,	-

Over 60 places infested by the gypsy moth have been located in this town. The most important colony was found at the Parker estate on the Billerica road, where over 130 nests were treated on 16 trees. The brown-tail moth is generally present throughout the town. A well-organized campaign against both moths is being carried on by the local superintendent in a very satisfactory manner. Next

season the street trees in the infested regions and on the main thoroughfares should be burlapped and sprayed, and the underbrush along infested roadsides should either be cut and burned or sprayed.

BILLERICA.

T. EMERY SMITH, *Local Superintendent.*

1905, amount required before reimbursement,	\$439 47
1906, amount required before reimbursement,	878 94
1905, amount expended in work against moths,	-
1905, amount of State reimbursement,	-

About 35 estates have been found infested with the gypsy moth in this town. The selectmen have made suitable provision for fall and winter work against both gypsy and brown-tail moths, but, owing to an unfortunate accident, the local superintendent has not yet been able to commence his work. We have assurances that the necessary operations will be started in the near future. This town is fortunate in possessing a large number of fine shade trees, and a great deal of burlapping with some spraying next season will be necessary to give them proper protection.

BOURNE.

HIRAM F. BAKER, *Local Superintendent.*

1905, amount required before reimbursement,	\$507 55
1906, amount required before reimbursement,	1,015 09
1905, amount expended in work against moths,	-
1905, amount of State reimbursement,	-

On Dec. 30, 1905, Inspector W. P. Flint found 3 small gypsy moth colonies in this town. The examination is in progress at this time, and we have assurances from the selectmen that the necessary work will be promptly organized.

BOXFORD.

JOHN PARKHURST, *Local Superintendent.*

1905, amount required before reimbursement,	\$203 60
1906, amount required before reimbursement,	407 19
1905, amount expended in work against moths,	319 54
1905, amount of State reimbursement,	115 94

This town has been found generally infested with the gypsy moth, although none of the colonies so far located are of large size. The insect is scattered throughout the entire area, as shown by an examination made by Inspector F. W. Parkins. The moths are most numerous in the central residential section, 26 egg clusters having been found on a single estate. The town has been scouted, with the exception of the West Boxford section, and this work will be completed before the eggs hatch. About one-third of the street trees in the town have been cleared of both species of moths. Next season the trees in the sections infested with the gypsy moth should be burlapped and thoroughly attended. The brown-tail moth is scattered throughout the town, although nowhere in excessive numbers.

BRAINTREE.

ELMER E. ABERCROMBIE, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$981 55
1906, amount required before reimbursement, . . .	1,963 09
1905, amount expended in work against moths, . . .	821 92
1905, amount of State reimbursement,	-

Braintree is generally infested with the gypsy moth, and bears practically the same relation to travel to southern Massachusetts towns as does Quincy or Weymouth to those located on the South Shore. A serious colony has been located in the northerly part of the town, and the fall inspection has shown egg clusters generally scattered in small numbers throughout the town, being most numerous near the Fore River. The street trees have been cleared of both species of moths, but much work remains to be done on private estates to bring the pests under control. Burlapping should be generally adopted next year throughout the town, and spraying possibly may be necessary in certain sections.

The condition of Braintree is most serious and demands a large amount of careful work. An effort will be made to inspect the woodland adjoining the Blue Hills Reservation, where it is feared that the gypsy moth may have established itself in considerable numbers.

BRIDGEWATER.

ROBERT J. MCNEELAND, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$614 16
1906, amount required before reimbursement, . . .	1,228 32
1905, amount expended in work against moths, estimated, .	23 00
1905, amount of State reimbursement,	—

Several estates in different parts of the town have been found infested by the gypsy moth, and the brown-tail moth occurs in small numbers. Practically all the necessary work on street trees has been done by the local superintendent, and work on private estates is now receiving his attention. Burlapping will be necessary next summer in the sections where the gypsy moth has been located.

BROCKTON.

EDWARD MOTTAU, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,500 00
1906, amount required before reimbursement, . . .	5,000 00
1905, amount expended in work against moths, . . .	255 76
1905, amount of State reimbursement,	—

A preliminary examination of Brockton was made during the caterpillar season and 7 localities were found to be infested with the gypsy moth. Since that time the street trees have been thoroughly examined and a few additional infested localities found. A complete inspection of the entire city will be made before the eggs hatch next spring.

The gypsy moth problem in Brockton is a most serious one, as the city is a notable electric car centre; it is peculiarly exposed to infestation from Quincy, Braintree, Milton and Boston, and, on the other hand, unless very thorough work is done here, the city may become a source of infestation for a large area of surrounding country. No important gypsy moth colonies have yet been found, and the brown-tail moths, though thoroughly scattered, are nowhere in serious numbers. The work against both species of moths has been accomplished in a very satisfactory manner by the local superintendent. It will probably be necessary to bur-lap the trees in the sections infested with the gypsy moth next season.

CANTON.

WILLIAM GALLIVAN, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$740 12
1906, amount required before reimbursement, . . .	1,480 24
1905, amount expended in work against moths, estimated, .	40 00
1905, amount of State reimbursement,	-

Two localities have been found infested by the gypsy moth, and the brown-tail moth occurs only in small numbers. The nests of both species of moths have been destroyed, both on street trees and on private estates. Burlapping will be necessary next season in the sections where the gypsy moth was found.

CARLISLE.

CHARLES FORBUSH, *Local Superintendent.*

1905, amount required before reimbursement,	\$80 71
1906, amount required before reimbursement,	161 41
1905, amount expended in work against moths,	-
1905, amount of State reimbursement,	-

A single gypsy moth colony was located in this town on the farm of F. C. Cook, but a careful roadside and orchard inspection failed to reveal any further signs of the insect. The brown-tail moth occurs in scattering numbers in orchards throughout the town. As yet there has been but a small amount of work against either insect, but we have assurances that the same will be taken up at an early date. It is important next year that the entire area of the town be thoroughly inspected, and that the trees in the vicinity of the gypsy moth colony be burlapped and attended.

CARVER.

E. H. MURDOCK, *Local Superintendent.*

1905, amount required before reimbursement,	\$303 42
1906, amount required before reimbursement,	606 84
1905, amount expended in work against moths, estimated, .	20 00
1905, amount of State reimbursement,	-

Seven localities have been found infested with the gypsy moth along the main road from Plymouth to Middleborough. The brown-tail moth has been noticed in small numbers

along roadsides and in orchards. All necessary work against both moths has been performed by the local superintendent. A limited amount of burlapping will be necessary here next year.

CHELMSFORD.

GEORGE B. B. WRIGHT, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$617 55
1906, amount required before reimbursement, . . .	1,235 09
1905, amount expended in work against moths, estimated, .	450 00
1905, amount of State reimbursement,	-

A single egg cluster found on the estate of Mrs. B. M. Wilson by the State inspector is the only evidence of the gypsy moth in Chelmsford, although the roadsides and orchards throughout the town have been generally examined. The brown-tail moth is present in average numbers throughout the entire area. Operations against this insect on street trees and those on public grounds are now in progress and should be completed by February 1. The town authorities have made suitable provision for the necessary work which is being carried out in a very satisfactory manner. The operations of next season should include a thorough inspection of the entire town, with burlapping in the section where the gypsy moth colony is located.

COHASSET.

JOHN S. CLARK, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,281 46
1906, amount required before reimbursement, . . .	2,562 89
1905, amount expended in work against moths, estimated, .	500 00
1905, amount of State reimbursement,	-

During the preliminary inspection of Cohasset in the caterpillar season, 12 localities were found to be infested with the gypsy moth, nearly all within a short distance of the centre of the town. After the eggs were laid, the street trees and many of the private estates were examined, with the result that about 100 places were found infested by the gypsy moth. The woodland area near the Turkey Hill district is somewhat infested and will be given a thorough examination before the eggs hatch next spring. The brown-

tail moth has been found scattered throughout the town. The local superintendent has inspected nearly all the street trees and has practically completed his work against the brown-tail moth, except on private estates. Next season the sections infested by the gypsy moth should be burlapped and carefully attended.

CONCORD.

WILLARD T. FARRAR, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,098 01
1906, amount required before reimbursement, . . .	2,196 01
1905, amount expended in work against moths, . . .	-
1905, amount of State reimbursement, . . .	-

Small gypsy moth colonies are widely scattered in Concord and the brown-tail moth is also in evidence. Some 45 estates are known to be infested with the gypsy moth, the largest colony being on the Lowell road, where 25 new nests were found. The ordinary procedure of burlapping and spraying next season should result in holding these infestations in check, and it is desirable that the town be thoroughly inspected at the earliest possible moment. Local work against the moths is now in progress and is being properly supported by the town officials.

DEDHAM.

GEORGE W. PHILLIPS, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,159 65
1906, amount required before reimbursement, . . .	4,319 29
1905, amount expended in work against moths, . . .	93 75
1905, amount of State reimbursement, . . .	-

Five gypsy moth colonies have been located in Dedham, which, being the county seat, is visited by travel from all directions. It is particularly important that these infestations be kept under control in order to prevent scattering of the caterpillars throughout the surrounding towns. The brown-tail moth occurs here in small numbers.

It has been difficult in this town to overcome local apathy, and, unless the necessary work is vigorously prosecuted in the near future, serious results will probably follow. The officials and citizens of this town should realize that the gypsy

moth is not a pest to be trifled with, and that a few dollars spent now in thorough work will be in the interests of true economy. If the gypsy moth is allowed to increase, large expenditures will be necessary in the course of a few years.

DOVER.

JOHN McCCLURE, *Local Superintendent.*

1905, amount required before reimbursement,	\$185 61
1906, amount required before reimbursement,	371 21
1905, amount expended in work against moths,	8 00
1905, amount of State reimbursement,	-

A partial examination of Dover has resulted in the discovery of 2 small gypsy moth colonies. The brown-tail moth occurs in scattering numbers throughout the town. The local officials have supported the work in a very satisfactory manner, and at this writing about two-thirds of the public trees have been cleared of the moths. Burlapping will be necessary next season in the sections infested by the gypsy moth.

DUXBURY.

HENRY H. LEWIS, *Local Superintendent.*

1905, amount required before reimbursement,	\$374 10
1906, amount required before reimbursement,	748 20
1905, amount expended in work against moths,	90 00
1905, amount of State reimbursement,	-

Eleven gypsy moth colonies have been located in this town, none of them of large size but all of importance because of the danger of scattering of caterpillars. The principal infestations are in the shore district. The town should be carefully inspected next season and a considerable amount of burlapping will be necessary. The brown-tail moth is generally scattered throughout the town. The work against both moths has been prosecuted in a most satisfactory manner by the local superintendent.

EAST BRIDGEWATER.

WILLIAM T. GREENE, *Local Superintendent.*

1905, amount required before reimbursement,	\$326 18
1906, amount required before reimbursement,	652 37
1905, amount expended in work against moths, estimated,	70 00
1905, amount of State reimbursement,	-

A small gypsy moth colony was found in this town in 1903. A thorough examination this year by the State inspectors has revealed 4 additional infested localities. The brown-tail moth is relatively scarce in the town. The local situation is well in hand, the work done by the superintendent being most satisfactory. Burlapping will be necessary another season in the sections infested with the gypsy moth.

FRAMINGHAM.

N. I. BOWDITCH, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,843 72
1906, amount required before reimbursement, . . .	3,687 44
1905, amount expended in work against moths, estimated, .	300 00
1905, amount of State reimbursement,	-

Framingham, from its location on the main avenue of travel between Boston and Worcester, is peculiarly liable to infestation; in fact, the gypsy moth was reported here in 1904. A preliminary inspection in the caterpillar season of 1905 revealed a small colony on Concord Street, which was burlapped and attended during the remainder of the season. Additional work by Inspectors I. L. Bailey and A. G. Smith of this office developed a very unfortunate general infestation of the town, the gypsy moth being found on about 100 estates. The principal colonies are in the three residential sections: Framingham Centre, South Framingham and Saxonville. The brown-tail moth is also quite generally scattered over the town, occurring in largest numbers at South Framingham and Saxonville.

The local moth work has been prosecuted with vigor and to our complete satisfaction. As soon as possible the entire woodland area should be scouted, and next season the usual burlapping for gypsy moth caterpillars and probably a limited amount of spraying will be required. The work of the local superintendent has been well supported by the town officials and citizens, and should make a satisfactory showing next year if the present liberal policy is continued.

GEORGETOWN.

WILLIAM BRAY, *Local Superintendent.*

1905, amount required before reimbursement,	\$195 86
1906, amount required before reimbursement,	391 72
1905, amount expended in work against moths,	107 90
1905, amount of State reimbursement,	-

A few gypsy moth egg clusters have been found at various points in Georgetown, and the brown-tail moth is commonly in evidence in orchards and woodland. The local superintendent has cleared the brown-tail nests from about one-third of the street trees and is carrying on the work in a satisfactory manner. Another season the trees in the localities where gypsy moths were found should be burlapped and receive careful attention.

In this town there was formerly a large woodland colony which was destroyed in 1899 by the employees of the State Board of Agriculture. In the time which has elapsed since the cessation of the former State gypsy moth work, there has been ample opportunity for any moths remaining in this colony to develop to noticeable numbers. But very careful examination made of the woodland in and around this colony has failed to reveal any form of the gypsy moth.

GROVELAND.

FRED A. WOOD, *Local Superintendent.*

1905, amount required before reimbursement,	\$209 52
1906, amount required before reimbursement,	419 03
1905, amount expended in work against moths,	173 43
1905, amount of State reimbursement,	-

None of the few gypsy moth colonies in this town are of notable size or present any special difficulties. The infestations are practically confined to the central residential district, and if thoroughly treated next season should be easily brought under control. The local superintendent has cleared the brown-tail moth nests from about one-half the street trees and has destroyed all gypsy moth egg clusters found. The trees in the localities infested with the gypsy moth should be burlapped next season and receive careful attention.

HALIFAX.

FRANK D. LYON, *Local Superintendent.*

1905, amount required before reimbursement,	\$63 11
1906, amount required before reimbursement,	126 21
1905, amount expended in work against moths, estimated, . .	10 00
1905, amount of State reimbursement,	-

A general examination of the street trees of Halifax has been completed by inspectors from this office, and as a result the gypsy moth has been found in 9 localities. A small infestation near the Hanson line has been reported by the local force of that town. Halifax is particularly exposed to infestation from the number of summer visitors in the Monponsett Pond section. The local work on street trees against both gypsy and brown-tail moths is completed, and practically all private estates have also received necessary attention. Burlapping in the sections infested by the gypsy moth will be necessary next summer. There are a few scattering brown-tail moth nests in Halifax.

HAMILTON.

GEORGE H. GIBNEY, *Local Superintendent.*

1905, amount required before reimbursement,	\$560 38
1906, amount required before reimbursement,	1,120 77
1905, amount expended in work against moths,	1,306 10
1905, amount of State reimbursement,	-

This town is generally infested with the gypsy moth. The most important colonies are at Asbury Park and around Chebacco Lake. In these sections there are a large number of summer cottages, and the danger of distribution from the colonies is great. Much thorough work will be necessary here next season.

In October a part of the infested roadsides was thinned out, and during November and December the brown-tail moth nests on street trees throughout the town were removed. The trees in the parts infested with the gypsy moth should be burlapped next season, and a certain amount of spraying will be necessary in the Asbury Park section.

HANOVER.

W. S. STODDARD, *Local Superintendent.*

1905, amount required before reimbursement,	\$274 16
1906, amount required before reimbursement,	548 32
1905, amount expended in work against moths, estimated, .	105 00
1905, amount of State reimbursement,	-

In this town 81 localities have been found infested by the gypsy moth, principally in the residential and farming sections. It is probable that the moth also occurs in small numbers in the woodlands, and here a careful inspection will be necessary in the near future. The brown-tail moth is generally scattered throughout the town, but has been well controlled by the work of the tree warden. This has been carried on in a very satisfactory manner, and if prosecuted with as much vigor next season the gypsy moth colonies should be brought under control.

HANSON.

A. L. DAME, *Local Superintendent.*

1905, amount required before reimbursement,	\$149 30
1906, amount required before reimbursement,	298 60
1905, amount expended in work against moths, estimated, .	60 00
1905, amount of State reimbursement,	-

Upward of 50 estates in Hanson are infested by the gypsy moth. The insect has been located in all sections of the town, and a great deal of careful work will be necessary to bring it under control. The town is unfortunate in having a large number of old decayed apple trees standing in or near infested places. Before thorough work can be done, these trees should be removed or properly trimmed and the cavities filled with cement. As yet we have been unable to make an inspection of the woodland in the northern part of the town, but this matter will receive attention in the near future from the local superintendent and his men. The necessary work against both gypsy and brown-tail moths has been completed by the local superintendent in a highly satisfactory manner. The brown-tail moth infestation in the town is light.

HAVERHILL.

HENRY FROST, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,500 00
1906, amount required before reimbursement, . . .	5,000 00
1905, amount expended in work against moths, . . .	785 70
1905, amount of State reimbursement,	-

Haverhill has been examined at different dates by the State inspectors, who found the gypsy moth on about a dozen private estates. The two principal colonies are at 40 Park Street and 15 York Street. There can be but little doubt that the city has become infested with the gypsy moth from the large amount of automobile travel passing through it from points to the southward.

The local work is in good hands, and is being carried out in a satisfactory manner. The brown-tail moth webs have been removed from about one-third of the city trees, and a considerable amount of work has been done by private citizens. Next season the trees in the sections infested by the gypsy moth should be burlapped and sprayed.

HINGHAM.

WARREN W. LOTHROP, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$872 69
1906, amount required before reimbursement, . . .	1,745 38
1905, amount expended in work against moths, estimated, .	100 00
1905, amount of State reimbursement,	-

During the caterpillar season 13 estates infested with the gypsy moth were located in Hingham, all within one-half mile of the railroad station. The fall inspection by the local superintendent showed 275 estates infested by the gypsy moth, but usually there were not more than one or two egg clusters in a place. While these moth colonies are scattered practically throughout the entire town, none of them offer any serious difficulties in the way of treatment. At this writing the street trees throughout the town have been cleared of the gypsy moth, and active operations against the brown-tail moth are in progress. The street trees of the town should be burlapped next season.

Hingham is in such a condition, as regards both gypsy and brown-tail moths, that, unless a large amount of thorough work can be done next season, the insects will soon increase to such an extent that a large annual expense will be necessary.

The town officials and citizens have shown a most commendable interest in prosecuting the work, and the efforts of the local superintendent have been well planned and carried out in a most satisfactory manner. Mention should be made of the good work done against the brown-tail moth in past years by Tree Warden A. W. Young which has materially reduced the cost of operations the present year.

HOLBROOK.

WILLIAM HAYDEN, *Local Superintendent.*

1905, amount required before reimbursement,	\$253 64
1906, amount required before reimbursement,	507 27
1905, amount expended in work against moths, estimated, . .	25 00
1905, amount of State reimbursement,	-

Seven different localities in this town have been found infested by the gypsy moth, while the brown-tail moth occurs in scattering numbers. The problem here is a relatively simple one if the trees can be burlapped and thoroughly attended next summer. The street trees and private estates as well have been cleared of both species of moths, and the work has been done in a very satisfactory manner.

HOPKINTON.

R. I. FRAIL, *Local Superintendent.*

1905, amount required before reimbursement,	\$327 86
1906, amount required before reimbursement,	655 71
1905, amount expended in work against moths,	-
1905, amount of State reimbursement,	-

The roadsides and orchards of this town have been generally inspected, and a single gypsy moth egg cluster found. The brown-tail moth occurs in very small numbers. The necessary work in this town as yet has not been done. It will include burlapping next season in the section where the gypsy moth was found.

HUDSON.

E. L. JEWETT, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$626 41
1906, amount required before reimbursement, . . .	1,252 82
1905, amount expended in work against moths, . . .	150 90
1905, amount of State reimbursement,	-

A single gypsy moth egg cluster has been found in the Cherry Street section of Hudson, and the brown-tail moth is very abundant in the residential district. The local authorities have taken up the work of clearing the street trees of both moths, and this operation is in progress at the present writing. Next season the trees in the gypsy moth infested district will require burlapping and careful attention.

HULL.

SMITH F. STURGIS, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$909 23
1906, amount required before reimbursement, . . .	1,818 45
1905, amount expended in work against moths, estimated, .	15 00
1905, amount of State reimbursement,	-

Hull is exposed to infestation through the immense amount of travel during the summer months from the entire metropolitan district. The gypsy moth has been found in serious numbers on the peninsula known as Hull Village. The badly infested section in the vicinity of Willow Street has been cleared by the local superintendent, who has also removed the nests of gypsy and brown-tail moths on all the street trees. There is a considerable brown-tail moth infestation in the town.

The work here has been performed in a very thorough manner, but it should be noted that the efforts of the local superintendent are seriously handicapped by the apathy of a large number of non-resident property owners. Most vigorous measures should be applied next season to suppress the moths. The trees throughout the town should be burlapped, and a considerable amount of spraying will be necessary in the worst infested sections.

HYDE PARK.

HARRY G. HIGBEE, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,500 00
1906, amount required before reimbursement, . . .	5,000 00
1905, amount expended in work against moths, estimated, .	350 00
1905, amount of State reimbursement,	-

One of the earliest findings of the gypsy moth outside the old infested district of 1899 was made in Hyde Park last May soon after the commencement of the State work. At that time the State superintendent was hopeful that this colony might be found to be on the outer border of the infested district, and, pending action of the local authorities, he had it thoroughly sprayed to destroy the caterpillars. Following this work the trees were burlapped and carefully attended during the summer, with the result that no other specimens of the gypsy moth were found in this locality.

Most unfortunately the fall inspection has revealed the gypsy moths generally scattered through the entire town, while several bad colonies have been discovered, notably the one in the Fairmount section. Here the trees on infested estates should be burlapped and attended, and spraying will doubtless be necessary, particularly on certain badly infested private estates. The brown-tail moth has been plentiful on street trees throughout the town.

The work against the moths in Hyde Park has been done in a very satisfactory manner, taking into consideration the large number of miles of streets, and the delay on the part of local authorities to provide suitable funds for the most economical prosecution of operations.

IPSWICH.

HENRY L. ORDWAY, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$743 19
1906, amount required before reimbursement, . . .	1,486 38
1905, amount expended in work against moths, . . .	1,184 89
1905, amount of State reimbursement,	-

A hasty examination of Ipswich was made in July by Inspector John Sweeney, who reported that the gypsy moth was scattered generally throughout the town. During the

fall examination many small colonies were found on private estates. There are no serious infestations here at present, but a great amount of work will be necessary to prevent the increase of the moth. During the late fall the infested roadsides were cut out and put in condition for spraying and burlapping. The nests of the brown-tail moth have been removed from the street trees in a part of the residential section. The infestation by this insect is greatest in the eastern part of the town.

Lying as Ipswich does in the path of the main line of travel along the North Shore, it is particularly exposed to infestation by the gypsy moth, and should have careful attention next season.

KINGSTON.

DANIEL WESTON, *Local Superintendent.*

1905, amount required before reimbursement,	\$283 29
1906, amount required before reimbursement,	566 57
1905, amount expended in work against moths, estimated, . .	50 00
1905, amount of State reimbursement,	-

The roads throughout the entire town have been inspected, and 29 small and widely scattered colonies of the gypsy moth found. While the moth occurs throughout the residential section, none of the colonies are of notable size, and all should be easily brought under control if the present thorough work can be continued during the coming year.

Brown-tail moths are generally in evidence throughout the town, but a great deal of work against these insects has been done by private citizens. Burlapping will be necessary in 1906 in the sections infested with the gypsy moth. The woodlands of the town should be inspected at the earliest possible moment.

LAKEVILLE.

S. T. NELSON, *Local Superintendent.*

1905, amount required before reimbursement,	\$124 86
1906, amount required before reimbursement,	249 71
1905, amount expended in work against moths, estimated, . .	7 00
1905, amount of State reimbursement,	-

Lakeville must be included in the list of infested towns, on the strength of the single gypsy moth egg cluster found. The roadside trees and those on estates adjacent to the high-

ways have been thoroughly examined by the local superintendent working with the State inspector, but no further infestations have been found.

In the section where the egg cluster was located, the trees should be burlapped and attended next season, and it will be well, if opportunity permits, to make an examination of the woodland area of the town.

LAWRENCE.

ISAAC KELLEY, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,500 00
1906, amount required before reimbursement, . . .	5,000 00
1905, amount expended in work against moths, . . .	-
1905, amount of State reimbursement,	-

Five small gypsy moth colonies were located last summer in Lawrence by Inspector D. G. Murphy. The brown-tail moth occurs commonly in the city. During recent years the local park board, having in charge the city trees, has followed a very liberal policy in combating insect pests of all kinds, and the work done by the local superintendent is entitled to particular commendation. At the present writing about one-half the street trees of the city have been inspected and cleared of both species of moths. It is expected that work on private estates will begin by February 1. The movement by citizens to suppress the moths has received an impetus from the efforts of the two local improvement societies, which have purchased the necessary tools and loaned them freely to all applicants. Several manufacturing corporations are also engaged in clearing their property of the moth pests.

The work of next season should include a limited amount of spraying together with burlapping, and thorough attention in the sections where the gypsy moth was found in 1905.

LINCOLN.

EDWARD R. FARRAR, *Local Superintendent.*

1905, amount required before reimbursement,	\$457 03
1906, amount required before reimbursement,	914 06
1905, amount expended in work against moths, estimated, . .	53 00
1905, amount of State reimbursement,	-

The gypsy moth is scattered over the entire area of Lincoln. All woodland tracts, so far as they have been inspected, are infested. The local superintendent has taken up the work with a great deal of energy, and has been properly supported by the town officials. As a result, practically all the necessary work against the moths on public trees has been accomplished, and steps are now under way to apply the provisions of the act to private estates. The infested roadside brush in several sections is a source of danger, since it will not be possible to keep the street trees free from the moths unless this brush is thoroughly treated. There exists, most naturally, strong local sentiment against cutting the brush along the highways, and, as an alternative, a great deal of spraying will be necessary in some places. This will materially increase the cost of the work, and a part of the expense may well be borne by those who insist upon this method of fighting the moth. A thorough inspection of the town should be made in the near future. Aside from the spraying mentioned, the trees in the localities infested by the gypsy moth should be burlapped next season and thoroughly attended.

MARLBOROUGH.

M. E. LYONS, *Local Superintendent.*

1905, amount required before reimbursement,	. . .	\$1,895 80
1906, amount required before reimbursement,	. . .	3,791 60
1905, amount expended in work against moths,	. . .	-
1905, amount of State reimbursement,	. . .	-

A small gypsy moth colony has been found in the Mount Pleasant Street section of Marlborough, but the brown-tail moth occurs in large numbers over the whole city, particularly in the residential district. But little has been done here as yet in the way of fall work, but we have assurances that operations against the moths will be taken up in the near future. It seems probable that a considerable expense will be involved in suppressing the brown-tail moth in this city. The gypsy moth infestation offers no special difficulties in the way of treatment.

MARSHFIELD.

W. L. SPRAGUE, *Local Superintendent.*

1905, amount required before reimbursement,	\$330 35
1906, amount required before reimbursement,	660 70
1905, amount expended in work against moths, estimated, . .	60 00
1905, amount of State reimbursement,	-

Eight estates in Marshfield have been found infested with the gypsy moth, and the brown-tail moth is generally scattered through the town. The gypsy moth infestations are practically all in the central residential district, and have received thorough treatment. The brown-tail moth nests have been removed from the street trees, and work against them on private estates is now under way and is being prosecuted with commendable vigor.

The citizens of this town are awake to the importance of suppressing the moths, and are co-operating to the fullest extent in this work.

MAYNARD.

LUKE S. BROOKS, *Local Superintendent.*

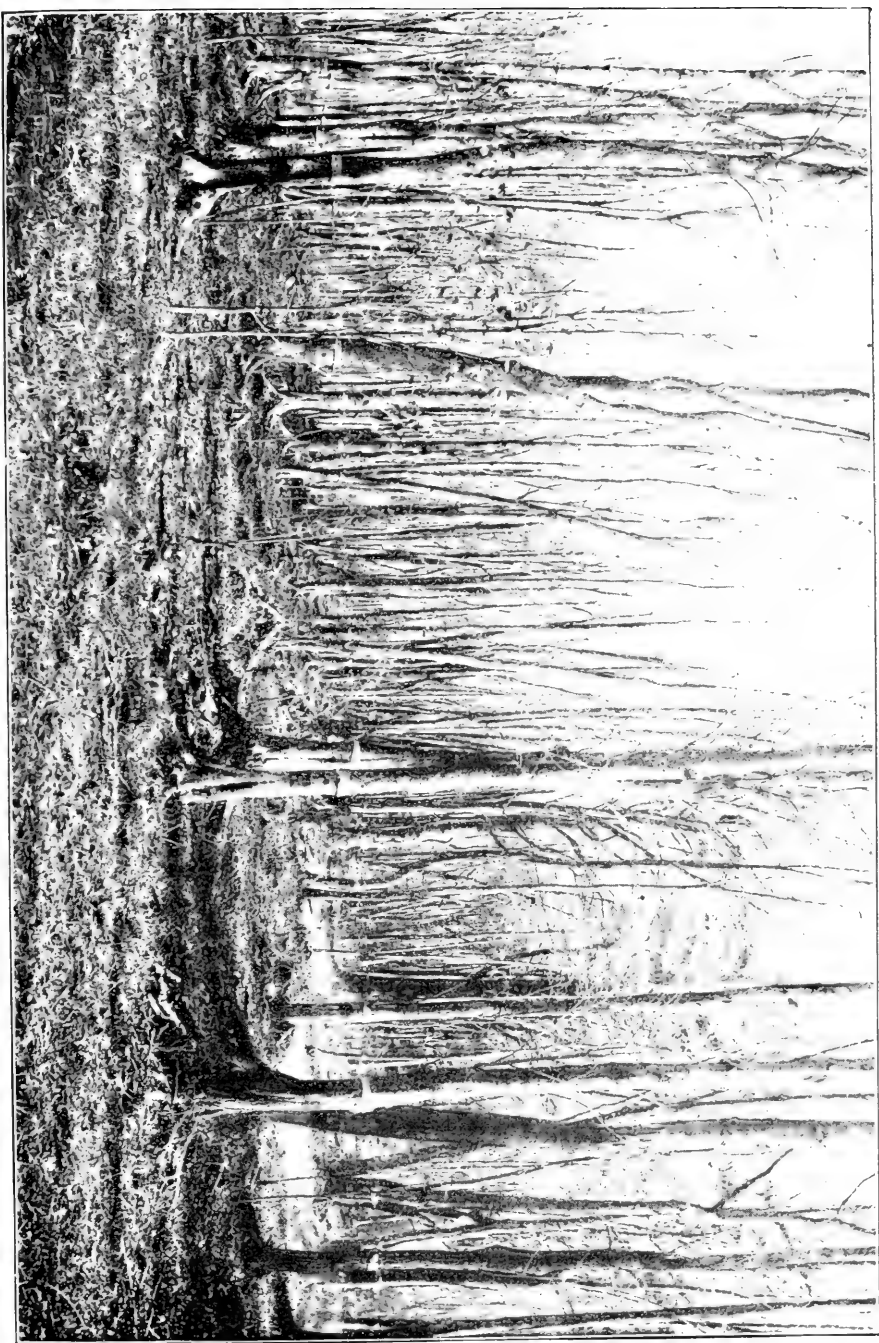
1905, amount required before reimbursement,	\$704 93
1906, amount required before reimbursement,	1,409 87
1905, amount expended in work against moths, estimated, . .	20 00
1905, amount of State reimbursement,	-

Inspection of the roadsides and orchards in this town revealed the presence of the brown-tail moth in considerable numbers, and a single estate infested by the gypsy moth. The local superintendent has shown a most commendable activity in prosecuting the necessary work, and has the situation well in hand. Further inspecting will be necessary next season, and the trees in the infested colony should be burlapped and attended.

MERRIMAC.

GILBERT G. DAVIS, *Local Superintendent.*

1905, amount required before reimbursement,	\$253 34
1906, amount required before reimbursement,	506 68
1905, amount expended in work against moths, estimated, . .	240 00
1905, amount of State reimbursement,	-



Thinning of infested woodland, as carried out by Gen. S. C. Lawrence, Medford, Mass.



While Merrimac is generally infested by the brown-tail moth, but a single gypsy moth egg cluster has been found, the infested locality being on School Street, near the central part of the town. Work against the brown-tail moth was begun about December 1, and has been carried on in a satisfactory manner. The trees in and near the section where the gypsy moth egg cluster was found should be burlapped next summer.

METHUEN.

HENRY WAGLAND, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,030 08
1906, amount required before reimbursement, . . .	2,060 16
1905, amount expended in work against moths, . . .	-
1905, amount of State reimbursement,	-

Four gypsy moth colonies have been located in this town, and the brown-tail moth is generally abundant, particularly in residential sections. The local work has been organized and carried out in a satisfactory manner. The trees throughout the residential section have been cleared of both species of moths, and work is now under way in the outskirts of the town. The property owners have received notification, and the enforcement of the law on private estates will commence about February 1. The local work has received cordial support both from town officials and from citizens in general. The burlap should be applied and attended next season where the gypsy moth colonies are located, and a thorough inspection of the town is desirable at an early date.

MIDDLEBOROUGH.

D. M. PRATT, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$826 29
1906, amount required before reimbursement, . . .	1,652 57
1905, amount expended in work against moths, estimated, .	30 00
1905, amount of State reimbursement,	-

The gypsy moth has been found in 3 places in Middleborough, viz., on Rock Street, Everett Street and North Main Street. The infestations are practically of the same nature as occur in other towns in southern Plymouth County,

only a few nests being found in one place. The brown-tail moth occurs here in small numbers.

A great deal of burlapping and other careful work will be necessary here; but, as the property owners are disposed to co-operate with the local superintendent, we are hopeful that the moths may be promptly suppressed. All necessary work against the moths has been completed in a very satisfactory manner.

MIDDLETON.

M. J. EMERSON, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$129 19
1906, amount required before reimbursement, . . .	258 37
1905, amount expended in work against moths, . . .	548 28
1905, amount of State reimbursement, . . .	419 09

The gypsy moth has been found generally scattered in Middleton, but no large colonies as yet have been located. The brown-tail moth is abundant everywhere, particularly in orchards and along roadsides. The most important findings of the gypsy moth were made along the road between Middleton and Danvers. A large hotel in the southern part of the town is much visited by summer travel, and the grounds here are quite seriously infested. This colony should have thorough attention to prevent a further scattering of the moth. The trees on the main streets of the town should be burlapped next season.

MILTON.

NATHANIEL T. KIDDER, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,500 00
1906, amount required before reimbursement, . . .	5,000 00
1905, amount expended in work against moths, . . .	585 26
1905, amount of State reimbursement, . . .	-

Milton is fortunate in having had for several years the services of a tree warden fully alive to the importance of suppressing the gypsy and the brown-tail moths, and as a result the insects have been kept well under control. Our inspection shows that the gypsy moth is scattered in small numbers throughout the town, including the woodlands in the southern part bordering on the Blue Hills Reservation.

The brown-tail moth is lightly scattered over the residential part of the town.

Practically all the necessary work against the brown-tail as well as the gypsy moth on street trees and private estates of the entire town is completed at this writing. The trees in the places infested with the gypsy moth should be burlapped next season, and in certain localities spraying may be necessary. It is also of importance to inspect the woodlands thoroughly at the earliest opportunity.

NATICK.

HENRY S. HUNNEWELL, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,325 73
1906, amount required before reimbursement, . . .	2,651 45
1905, amount expended in work against moths, . . .	-
1905, amount of State reimbursement,	-

Upward of 65 private estates in Natick have been found infested by the gypsy moth, with scattering infestation on street trees. The brown-tail moth occurs in average numbers throughout the town. The local superintendent has under way a more thorough inspection of the town, and we have assurances that the clearing of the street trees will be taken up at an early date. The gypsy moth colonies offer no particular difficulties in the way of treatment, but the trees in them should be burlapped and sprayed next season.

This town possesses many beautiful estates, on which numerous fine specimen trees may be found. It is of the utmost importance, therefore, that the moth be exterminated here, or brought thoroughly under control at the earliest possible date.

NEEDHAM.

ERNEST E. RILEY, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$808 24
1906, amount required before reimbursement, . . .	1,616 48
1905, amount expended in work against moths, . . .	105 97
1905, amount of State reimbursement,	-

This town is generally infested by both the gypsy and the brown-tail moths. The inspection of roadsides and orchards

has shown some 26 gypsy moth colonies, principally in the Highlandville section. The brown-tail moth is scattered in average numbers over the town. The gypsy moth colonies should be easily brought under control if the present hearty co-operation of the local authorities is continued. The necessary local work is in progress, and has been carried out in a very satisfactory manner. Further inspection of the woodland should be made at the earliest possible moment.

NEWBURY.

BENJAMIN PEARSON, *Local Superintendent.*

1905, amount required before reimbursement,	\$239 36
1906, amount required before reimbursement,	478 72
1905, amount expended in work against moths,	549 33
1905, amount of State reimbursement,	-

The egg clusters of the gypsy moth have been found scattered throughout Newbury, being particularly abundant in the Oldtown section, where as many as 20 nests have been found on a small estate. The most important infestations are along the main road leading to Newburyport. About one-half of the street trees have been cleared of both gypsy and brown-tail moths by the local superintendent, and the work is in progress at this writing. The trees in the sections infested with the gypsy moth should be burlapped next season, and spraying will be necessary in a few localities. A number of large orchards which are infested should be sprayed. The condition of the woodland in this town has not been determined, but an effort will be made to have it inspected during the winter and spring.

NEWBURYPORT.

THOMAS T. UPTON, *Local Superintendent.*

1905, amount required before reimbursement,	\$2,162 17
1906, amount required before reimbursement,	4,324 35
1905, amount expended in work against moths,	1,266 84
1905, amount of State reimbursement,	-

From its topographical position the condition of Newburyport is of particular importance, since nearly all the travel to New Hampshire points passes through it, and any

moth colonies existing here are a source of danger to a wide-spread area. The gypsy moth has been found generally scattered throughout all parts of the city, and the brown-tail moth is notably abundant. A thorough inspection of the city has been made, with the result that nearly every section has been found infested with the gypsy moth. The largest number of colonies was found in the residential section. Many of them were of considerable size, over 100 nests being found on a single estate. The residential section was cleared of the brown-tail moth nests in the spring of 1905, and as a result there was but little damage by these caterpillars during the summer.

In November and December the local superintendent, with a small gang of men, carried on work against both insects on the public shade trees. It has appeared to be difficult to secure a suitable number of employees to carry on the work to greatest advantage, and, as a consequence, only about one-fourth of the public trees have been cleared of the moths. Steps are now being taken to increase the force of men, and it is expected that the entire city will be covered before the egg clusters of the gypsy moth hatch, next spring. A great deal of very careful work will be necessary here to keep the gypsy moth under control. The trees in the entire city should be burlapped next season and carefully attended; in addition, spraying will be needed in the worst-infested sections.

NORTH ANDOVER.

PETER HOLT, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$891 65
1906, amount required before reimbursement, . . .	1,783 29
1905, amount expended in work against moths, estimated, .	805 00
1905, amount of State reimbursement,	-

Gypsy moths were first found in 1904 in this town. An examination in the summer of 1905 by an inspector from this office showed the insect to be present in about half a dozen localities. The town as yet has not been completely scouted, and this work should have attention next year. Burlapping will be necessary on trees in the known gypsy

moth colonies. The brown-tail moth is present in average numbers. As yet but little has been done by the local authorities, owing in part to the important business interests of the local superintendent; but we have assurances that a vigorous campaign against the two insects will be completed during the winter months.

NORTH READING.

F. HOWARD MOSSMAN, *Local Superintendent.*

1905, amount required before reimbursement,	\$133 73
1906, amount required before reimbursement,	267 47
1905, amount expended in work against moths,	238 55
1905, amount of State reimbursement,	-

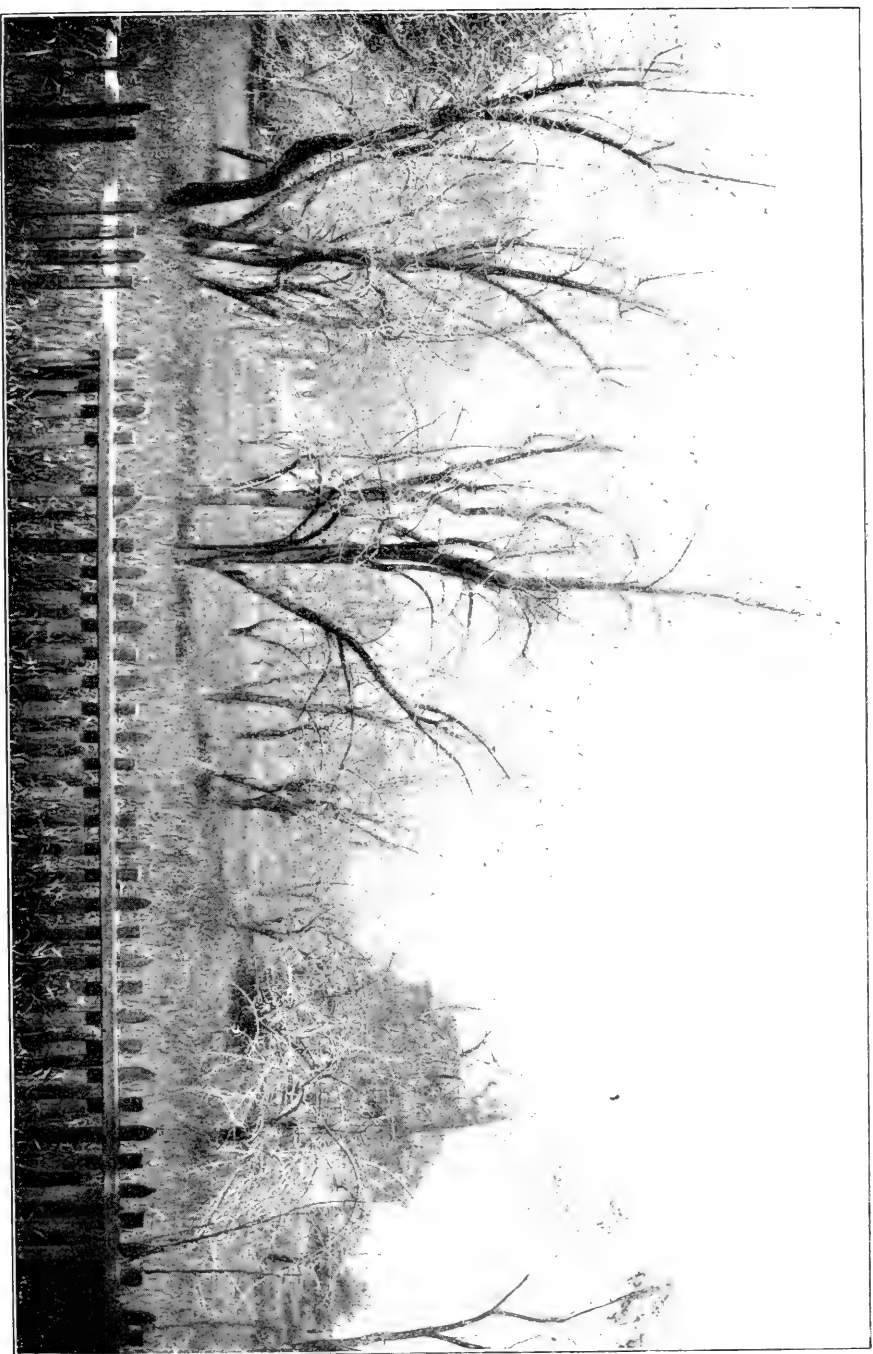
The southern and eastern sections of North Reading are generally infested by the gypsy moth. The roadsides in this district contain numerous colonies, and nearly every old apple orchard shows specimens of both brown-tail and gypsy moths. The general infestation by the gypsy moth is unfortunate because of the amount of woodland in the town. It should be checked before it has opportunity to spread farther. Already a considerable wooded area lying near Haverhill and Pleasant streets is generally infested, and a colony of importance has been located on the town farm at Park Street. The work of the local superintendent is now under way, and is being carried on in a satisfactory manner. A great deal of cutting and burning of worthless trees will be necessary, together with burlapping and spraying, next season, in order to hold the gypsy moth in check, and many miles of infested roadsides should have attention. The local operations to date have been properly supported by the selectmen.

NORWELL.

JOHN H. SPARRELL, *Local Superintendent.*

1905, amount required before reimbursement,	\$167 46
1906, amount required before reimbursement,	334 91
1905, amount expended in work against moths, estimated, . .	85 00
1905, amount of State reimbursement,	-

Inspector Harry B. Ramsey located the gypsy moth early in August at 10 different places in Norwell. A thorough



Ravages of brown-tail moth caterpillars in neglected pear orchard. Winchester, June, 1905.

inspection of the residential section of the town is now completed, and no additional infestations have been discovered. The local superintendent has cleared the street trees of both species of moths, and has also performed the work necessary on private estates. The infested sections will require bur-lapping and careful attention next year.

The brown-tail moth is more or less distributed over the residential portion of the town, but so far as known it has not yet invaded the woodlands.

NORWOOD.

FRANK H. WINSLOW, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,025 55
1906, amount required before reimbursement, . . .	2,051 09
1905, amount expended in work against moths, estimated, .	15 00
1905, amount of State reimbursement,	-

Four gypsy moth colonies have been found in Norwood. None of them are of large size, but in one case the infestation is complicated by a number of hollow trees, which must be either removed or cemented. The brown-tail moth is not abundant here, and, if the gypsy moth infestations receive thorough treatment next season, the problem of suppressing the insects should not prove a difficult one. A limited amount of work has been done against the moths by the local superintendent. The entire town should have a thorough inspection at the earliest possible date.

PEMBROKE.

CALVIN S. WEST, *Local Superintendent.*

1905, amount required before reimbursement,	\$189 78
1906, amount required before reimbursement,	379 56
1905, amount expended in work against moths,	95 18
1905, amount of State reimbursement,	-

In the latter part of August the gypsy moth was found in this town by the State inspector, and since that time 12 additional infestations have been located. As in the case of other towns in this vicinity, the moth was found widely scattered, as no more than a single nest as a rule was found in any particular locality. A few brown-tail moth webs

have been found in the town. Nearly all the necessary work against both species of moths has been done in a very satisfactory manner by the local superintendent. The sections infested by the gypsy moth should be burlapped and carefully attended next season.

PLYMOUTH.

GEORGE R. BRIGGS, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$1,869 74
1906, amount required before reimbursement, . . .	3,739 47
1905, amount expended in work against moths, . . .	-
1905, amount of State reimbursement,	-

The infestations of the gypsy moth in Plymouth are of particular importance because of the immense amount of summer travel which finds its way here. We are unable at this writing to state how badly the town is infested, but already the moth has been found scattered in small numbers throughout the entire residential section, and a single nest has been found at Long Pond village and at Darby Pond. The large amount of woodland in Plymouth should be thoroughly inspected at the first opportunity. A great deal of camping takes place here each summer, one of the circumstances that render the camp sites in the wooded area peculiarly liable to infestation by the moth. The brown-tail moth has been kept under control in past years by the efficient local superintendent. At this writing work against both species of moths is being prosecuted vigorously and in a very satisfactory manner. Burlapping will be necessary next year wherever the gypsy moth exists.

PLYMPTON.

ZINA E. SHERMAN, *Local Superintendent.*

1905, amount required before reimbursement,	\$66 24
1906, amount required before reimbursement,	132 48
1905, amount expended in work against moths, estimated, .	25 00
1905, amount of State reimbursement,	-

Six small gypsy moth colonies have been found in widely separated localities in this town. A local gang has been or-

ganized and instructed by Inspector C. S. Mixter, Jr., of this office, and the necessary work against the moths is practically completed at this writing. The brown-tail moth is not very abundant in the town, and the expense of the necessary work against both species will be small, unless the general inspection which will be made in the near future should reveal the presence of large gypsy moth colonies.

RANDOLPH.

ROYAL T. MANN, *Local Superintendent.*

1905, amount required before reimbursement,	\$399 05
1906, amount required before reimbursement,	798 10
1905, amount expended in work against moths, estimated, .	15 00
1905, amount of State reimbursement,	-

The State inspectors from this office have located 10 places infested with the gypsy moth in Randolph, principally in the residential section. One finding of the moth was made on the roadside in the woods near the Blue Hills Park Reservation. As yet there has been no thorough inspection of woodland. The local superintendent has cleared the street trees of both species of the moths, and is now carrying on the necessary work on private estates where the brown-tail moth occurs in small numbers. The sections where the gypsy moth has been located should be burlapped next season, and the colonies near the park reservation should be thinned out and put in proper condition for treatment.

ROCKLAND.

FRANK H. SHAW, *Local Superintendent.*

1905, amount required before reimbursement,	\$659 09
1906, amount required before reimbursement,	1,318 18
1905, amount expended in work against moths, estimated, .	250 00
1905, amount of State reimbursement,	-

Eight gypsy moth colonies have been located in the central part of the town, and the inspection is still in progress. None of the colonies so far found are of large size, and it should be easy to bring them under control by the application of thorough methods. The usual method of burlapping

the trees in the infested sections should be followed next season. The brown-tail moth is generally scattered throughout the town. The work of destroying both moths is now in progress and will be completed in the near future.

ROCKPORT.

ELI GOTT, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$614 54
1906, amount required before reimbursement, . . .	1,229 08
1905, amount expended in work against moths, . . .	688 11
1905, amount of State reimbursement, . . .	73 57

Rockport was thoroughly examined by an inspector from this office, and as a result the gypsy moth was found scattered throughout the entire town. In several orchards the moth was found in large numbers. The local superintendent has carried on his work with marked enthusiasm and ability, and has cleared from all the street trees the nests of both brown-tail and gypsy moths. A limited amount of cutting has been done along the infested roadsides. The trees in the central part of the town and in other infested localities should be burlapped next season and carefully attended.

ROWLEY.

DANIEL O'BRIEN, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$148 78
1906, amount required before reimbursement, . . .	297 56
1905, amount expended in work against moths, . . .	248 73
1905, amount of State reimbursement, . . .	-

In one colony near the Ipswich line in Rowley a large number of gypsy moths were found, and numerous scattering colonies were located in orchards throughout the town by the State inspector. In addition, a few gypsy moths occur in widely separated localities in the town. During November and December a small gang of men in charge of the local superintendent was engaged in clearing the nests of both brown-tail and gypsy moths from the shade trees, and has now covered about two-thirds of the town. The brown-tail moth has been found particularly abundant in

that part of the town near the marshes. The shade trees in the sections infested with the gypsy moth will require burlapping next year.

SALISBURY.

HENRY C. RICH, *Local Superintendent.*

1905, amount required before reimbursement,	\$170 50
1906, amount required before reimbursement,	340 99
1905, amount expended in work against moths,	762 19
1905, amount of State reimbursement,	591 69

Throughout this town the gypsy moth is scattered in small numbers, and the brown-tail moth is everywhere in evidence. The principal gypsy moth infestations are in the residential section, particularly in orchards. During the month of November the local superintendent organized a small gang which has done very good work on the street trees. The roadsides have been cleared of the brush in a few of the gypsy moth colonies, but more work of this kind will be necessary before the moth can be combated to advantage. Burlapping and spraying may be necessary next season throughout the residential section.

SCITUATE.

JETSON WADE, *Local Superintendent.*

1905, amount required before reimbursement,	\$701 91
1906, amount required before reimbursement,	1,403 93
1905, amount expended in work against moths, estimated, .	110 00
1905, amount of State reimbursement,	-

In the summer of 1904 a single gypsy moth caterpillar was sent from Scituate to the office of the State Board of Agriculture. This was the first evidence of the occurrence of the moth in the town. As yet we have been unable to make a thorough inspection of the entire area, but as far as this work has progressed a few egg clusters have been found at widely separated points. It is important that a thorough inspection of the town be made in the near future, and that next season the trees in the infested sections be burlapped and thoroughly attended. The existence of a large area of woodland in the town emphasizes the importance of thorough

work against the moth here. The local superintendent has cleared the brown-tail moth webs from the street trees and from many private estates.

SHERBORN.

WALTER CHANNING, JR., *Local Superintendent.*

1905, amount required before reimbursement,	\$178 90
1906, amount required before reimbursement,	357 80
1905, amount expended in work against moths, estimated, .	40 00
1905, amount of State reimbursement,	-

The gypsy moth has been found on 10 estates in this town, and the brown-tail moth has been observed in small numbers. None of the gypsy moth colonies offer any particular difficulties in the way of treatment, if the work can be carried on in a vigorous manner. The town officials have shown a most helpful spirit in the matter, and the necessary work is being done in a thoroughly satisfactory way by the local superintendent. The trees in the gypsy moth colonies should be burlapped and carefully attended next season.

SOUTHBOROUGH.

HARRY BURNETT, *Local Superintendent.*

1905, amount required before reimbursement,	\$283 92
1906, amount required before reimbursement,	567 84
1905, amount expended in work against moths, estimated, .	100 00
1905, amount of State reimbursement,	-

A single gypsy moth egg cluster was found at Fayville, in Southborough, by the State inspector, and a very general infestation by the brown-tail moth was observed in the town. The necessary work against the moths has been carried on here in a most excellent manner, and if continued under the present management should show satisfactory results next season. In Southborough in past years a great deal of good work has been done in suppressing serious shade tree insects.

STOUGHTON.

WILLIAM P. KENNEDY, *Local Superintendent.*

1905, amount required before reimbursement,	\$636 46
1906, amount required before reimbursement,	1,272 92
1905, amount expended in work against moths,	282 00
1905, amount of State reimbursement,	-

Two places in Stoughton have been found infested by the gypsy moth. The egg clusters have been destroyed, and next season the trees should be burlapped and carefully attended. The brown-tail moth is generally distributed throughout the entire town, but there appear to be no serious difficulties in controlling either insect if suitable funds are available. The town officials have been prompt to comply with every suggestion from this office, and as a result we are hopeful that the moths will soon be brought under control.

STOW.

J. E. WELCH, *Local Superintendent.*

1905, amount required before reimbursement,	\$161 52
1906, amount required before reimbursement,	323 02
1905, amount expended in work against moths,	80 30
1905, amount of State reimbursement,	-

The inspection of roadsides, orchards and several private estates in this town revealed a single gypsy moth egg cluster, and the brown-tail moth was observed in small numbers. The necessary suppressive work was promptly done, but a further inspection will be necessary. The usual work of burlapping will be required next season in the gypsy moth colony.

SUDBURY.

WILLIAM E. BALDWIN, *Local Superintendent.*

1905, amount required before reimbursement,	\$236 52
1906, amount required before reimbursement,	473 04
1905, amount expended in work against moths, estimated,	75 30
1905, amount of State reimbursement,	-

Nine estates in Sudbury have been found infested by the gypsy moth, the principal colony being located on Landham Road. The brown-tail moth occurs in serious numbers in the southern part of the town, and is generally scattered elsewhere over the entire area. The work in this town has been organized, and is being prosecuted in a satisfactory manner. About two-thirds of the area of the town has been covered at this writing.

TEWKSBURY.

CHARLES K. FRENCH, *Local Superintendent.*

1905, amount required before reimbursement,	\$354 03
1906, amount required before reimbursement,	708 06
1905, amount expended in work against moths,	270 82
1905, amount of State reimbursement,	-

In August the inspector from this office located 3 gypsy moth colonies in Tewksbury, respectively on East and Fiske streets and on the State farm. The town has made suitable provision for the work against the moths, which has been carried on in a satisfactory manner. Nearly all the street trees of the town have been cleared of both gypsy and brown-tail moths, the latter insect occurring in average numbers. A thorough inspection of the town will be in order next season, and burlapping will be necessary in certain localities.

TOPSFIELD.

W. A. WIGHT, *Local Superintendent.*

1905, amount required before reimbursement,	\$190 24
1906, amount required before reimbursement,	380 47
1905, amount expended in work against moths,	626 45
1905, amount of State reimbursement,	-

In this town the gypsy moth is scattered widely, but no colonies of notable size are known. The principal infestation is in the residential section. As might be expected, several infestations have been found along the Newburyport turnpike, the main avenue of travel in this district. No examination has been made as yet of the woodland, but it is feared that the moths may be found there in scattering numbers. This inspection should have attention before the eggs hatch next spring. The local superintendent has cleared both brown-tail and gypsy moths from the street trees over approximately one-half the town, and is carrying on the work in a satisfactory manner. The trees in the infested sections should be burlapped and given attention next season. The brown-tail moths are in scattered, but not excessive numbers in the town.

WAREHAM.

JAMES J. WALSH, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$658 31
1906, amount required before reimbursement, . . .	1,316 62
1905, amount expended in work against moths, estimated, .	25 00
1905, amount of State reimbursement,	-

One egg cluster of the gypsy moth was found by Inspector L. A. Minott on the Rochester road at South Wareham. Mr. Minott also found a dead pupa of the moth on the Marion road. The gypsy moth infestation in Wareham, so far as known, is therefore slight, and seems to offer no particular difficulty in the way of treatment.

Only a few brown-tail moths have been observed in the town. The selectmen are fully aware of the importance of suppressing the moths. The thorough use of burlap next season should be sufficient to bring the gypsy moth under control, if not to exterminate it from this town.

WAYLAND.

PETER LEVITRE, *Local Superintendent.*

1905, amount required before reimbursement,	\$382 54
1906, amount required before reimbursement,	765 08
1905, amount expended in work against moths, estimated, .	10 00
1905, amount of State reimbursement,	-

Thirty-nine estates infested by the gypsy moth have been located in this town, and the brown-tail moth occurs in scattering numbers. In a single orchard on Rice Road 114 gypsy moth egg clusters were found at the time of the fall examination. This colony adjoins woodland, and therefore presents a serious problem. The local superintendent has taken up the work in a satisfactory manner, and has completed the clearing of the street trees at this writing. It is important that the woodland in this town be given a further inspection, and that next season a vigorous campaign of burlapping and spraying be adopted.

WELLESLEY.

F. M. ABBOTT, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$2,221 43
1906, amount required before reimbursement, . . .	4,442 85
1905, amount expended in work against moths, . . .	246 41
1905, amount of State reimbursement,	-

Wellesley is generally infested by the gypsy and brown-tail moths. None of the colonies so far observed are of particular size, but the conditions are ripe for a serious moth outbreak in the near future, unless vigorous measures are employed. The local superintendent has taken up the work with a great deal of enthusiasm, and is carrying on a thorough inspection of the entire town. The fall work against the moths is also under way, and is being carried out in a most satisfactory manner. The usual campaign of burlapping and possibly spraying will be necessary here next year.

WENHAM.

S. W. WOODASON, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$420 40
1906, amount required before reimbursement, . . .	840 80
1905, amount expended in work against moths, . . .	1,043 45
1905, amount of State reimbursement,	623 05

This town is now generally infested by the gypsy moth. Only small numbers of the insect have been found in each locality examined, but the pest is thoroughly scattered over the entire town. During November the local superintendent cut the brush along the roadsides in the infested sections. At the present writing the nests of both brown-tail and gypsy moths on street trees throughout the greater part of the town have been destroyed. A large amount of work, particularly burlapping and spraying, must be done next season in this town. The work by the local superintendent has been thorough and efficient, and should yield good results next season.

WEST BRIDGEWATER.

ARTHUR W. HIATT, *Local Superintendent.*

1905, amount required before reimbursement,	\$223 24
1906, amount required before reimbursement,	446 48
1905, amount expended in work against moths,	15 00
1905, amount of State reimbursement,	—

A single egg cluster of the gypsy moth has been found in this town on Main Street near Ash Street. The brown-tail moth is very scarce throughout the entire area. The use of burlap next season will be imperative in the place where the gypsy moth egg cluster was found.

WEST NEWBURY.

WILLIAM MERRILL, *Local Superintendent.*

1905, amount required before reimbursement,	\$208 52
1906, amount required before reimbursement,	417 04
1905, amount expended in work against moths,	660 64
1905, amount of State reimbursement,	452 12

A few gypsy moth egg clusters have been found in the central residential section of this town. The local superintendent has carried on a vigorous campaign against the brown-tail moth, and has practically completed clearing the street trees of this insect. The work has been carried on in a thorough manner, and should yield good results next season if followed up by burlapping in the localities infested with the gypsy moth. The roadside brush has been cut out in the infested district and the trees put in proper condition for next season's work.

WESTON.

F. G. COOPER, *Local Superintendent.*

1905, amount required before reimbursement,	\$1,099 50
1906, amount required before reimbursement,	2,199 00
1905, amount expended in work against moths,	254 48
1905, amount of State reimbursement,	—

During the caterpillar season Inspector H. W. Vinton found gypsy moth larvæ in Weston, scattered along North Avenue from the Waltham line nearly to Lincoln. The fall

examination developed a general infestation by the gypsy moth over the entire town, this being most notable on Central Avenue. Over 300 nests have been treated in the Linwood Cemetery, and the adjoining woodland is also somewhat infested. The condition with regard to the gypsy moth in Weston is most serious, because of the large amount of woodland exposed to infestation, if indeed not already infested. A thorough inspection of the entire town is imperative at the earliest possible moment. The brown-tail moth is generally distributed in the town, and is notably abundant in the white oak woodlands. The town officials have co-operated fully in suppressing the moths, although the efforts of the local superintendent have been somewhat handicapped by reason of his other business interests. The work on public trees has been completed, and that on private estates is being carried on at this writing.

WESTWOOD.

C. H. SOUTHERLAND, *Local Superintendent.*

1905, amount required before reimbursement,	\$415 96
1906, amount required before reimbursement,	831 93
1905, amount expended in work against moths, estimated,	50 00
1905, amount of State reimbursement,	-

An infestation by the gypsy moth was reported from this town by Dr. H. T. Fernald, Amherst, Mass., to whom specimens of the insect had been sent for identification. An examination by Inspector E. M. Sadler during the past month shows a single infested tree in the section from which these specimens were taken. The brown-tail moth is not abundant in this town. If the infested tree, which is badly decayed, is cut and burned this winter, and the trees in the immediate vicinity burlapped next season, this colony should be exterminated.

WEYMOUTH.

DUMMER SEWALL, *Local Superintendent.*

1905, amount required before reimbursement,	\$1,413 07
1906, amount required before reimbursement,	2,826 15
1905, amount expended in work against moths, estimated,	175 00
1905, amount of State reimbursement,	-

Two serious gypsy moth colonies are known in Weymouth, and the insect has been found in scattering numbers throughout the entire area. The infestations along the main line of travel from Boston and Quincy are of particular importance because of the danger of farther distribution of the moth by vehicles.

Throughout the town the brown-tail moth is present in serious numbers. To such an extent is this town infested by the latter insect that last summer there was a great deal of complaint from summer visitors because of poisoning by the caterpillars. The street trees throughout the town have been cleared of the gypsy moth egg clusters, and work against the brown-tail moth is now under way. During the fall inspection many gypsy moth egg clusters observed on private estates were destroyed, but a great deal of work of this kind remains to be done. The efficient work of the local superintendent has been heartily supported by the town officials, and should show good results next season. The street trees throughout the town should be burlapped, and much thorough work will also be required on private estates. The gypsy moth infestation of this town is among the most disquieting features of the situation in the entire district south of Boston.

WHITMAN.

CLARENCE A. RANDALL, *Local Superintendent.*

1905, amount required before reimbursement, . . .	\$787 16
1906, amount required before reimbursement, . . .	1,574 32
1905, amount expended in work against moths, estimated, .	60 00
1905, amount of State reimbursement,	-

Some 25 estates infested by the gypsy moth have been found in this town, which as yet has not been completely inspected. The principal infestations are along Washington Street, the main thoroughfare. The brown-tail moth is generally in evidence in small numbers throughout the town. Work against both moths on the street trees has been completed, and a number of the private estates have been examined. We have assurances that this latter work will be prosecuted with much vigor in the near future, and that everything necessary will be done before the hatching period of the egg clusters.

WILMINGTON.

WILLIAM L. KELLEY, *Local Superintendent.*

1905, amount required before reimbursement,	\$245 50
1906, amount required before reimbursement,	491 00
1905, amount expended in work against moths,	-
1905, amount of State reimbursement,	-

A few small gypsy moth colonies have been found, principally in the southern part of the town, while the brown-tail moth occurs generally throughout the entire area. The other business interests of the local superintendent have prevented him from giving the necessary attention to the work of destroying the moths, or as much as he probably would have given under other circumstances. At the present writing active work has just commenced under the direction of a competent foreman, and we have assurances that it will be prosecuted with vigor until completed. A general campaign of burlapping will be necessary next season in the town, with possibly a small amount of spraying in certain localities.

YARMOUTH.

CHARLES R. BASSETT, *Local Superintendent.*

1905, amount required before reimbursement,	\$363 20
1906, amount required before reimbursement,	726 40
1905, amount expended in work against moths,	-
1905, amount of State reimbursement,	-

Late in December a single egg cluster was found by an inspector from this office on a street tree near the centre of the town. The brown-tail moth is much in evidence, and we have assurances that the local work will be promptly organized and prosecuted with vigor.

SUMMARY OF CONDITION OF TERRITORY.

The general condition of the territory occupied by the gypsy moth may be briefly summarized as follows: in the section lying east of a line drawn through Newton, Waltham, Lexington and Burlington, and running northeasterly through Reading, Danvers and Manchester, the infestation is now most alarming. Residential sections in all these central

towns are thoroughly infested, egg clusters are numerous on street trees, and large areas of woodland have been seriously devastated by caterpillars. Outside of this central infested district there are notable colonies at Quincy, Hyde Park, North Reading, Gloucester, Ipswich and Newburyport, while the condition of other infested localities, such as Hingham, Weymouth, Braintree, Concord, Weston, Wenham and Essex, is sufficient to cause gravest anxiety for the future. It may well be said that throughout the central infested district there will undoubtedly be severe injury to woodlands during the caterpillar season of 1906. The funds at present available will hardly suffice to keep the street trees and private estates reasonably clear from the moths, while in the outlying towns much hard work will be required to prevent the pest from increasing to formidable proportions. To secure a reasonable measure of success in controlling the gypsy moth, the heartiest co-operation on the part of all property owners is an imperative necessity.

Throughout all the territory occupied by the gypsy moth the brown-tail moth occurs in varying numbers, the most severe infestations being to the north of Boston. The insect has also shown itself in important numbers in such centres of population as Worcester, Fitchburg, Leominster and Gardner. The principal spread of this insect has been along the coast line and in a northerly direction over the interior cities and towns.

WORK FOR 1906.

During the coming winter months the work of destroying nests of both gypsy and brown-tail moths on street trees, in parks and on other public reservations throughout the infested district will be pushed as rapidly as is consistent with thoroughness. Special effort will be made to induce property owners to clear their estates of the moths; and it is now intended that all this private work shall be inspected by trained employees of the local forces or by inspectors from this office, in order to detect and destroy any infestations that may have been overlooked. It is apparent that the act will not yield sufficient revenue to do all that could

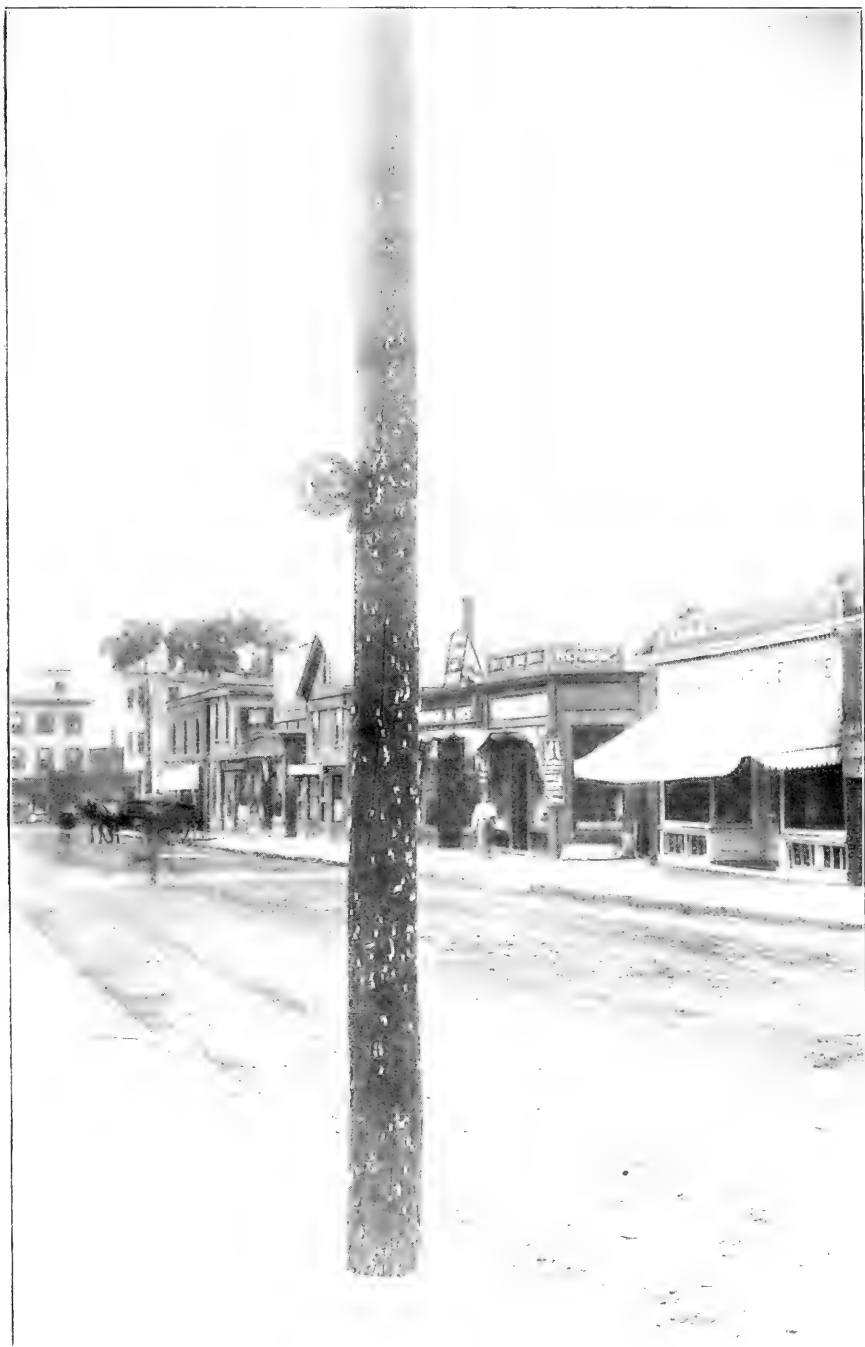
be desired on private estates above the owners' financial liability. Such being the case, the principal efforts will be directed to stamping out the moths in the most generally infested residential sections. So far as funds permit, the woodlands having the worst gypsy moth infestation will be thinned, the egg clusters on the remaining trees destroyed, and the colonies put in condition for economical banding or spraying.

As soon as the gypsy moth eggs hatch next spring, these colonies should be burned over with a light fire to destroy the young caterpillars on the ground growth. Burlapping for caterpillars will be desirable on street trees generally throughout the central infested district. Arrangements are being perfected for a vigorous campaign of spraying. In many of the central towns all the street trees should be sprayed; in the outlying towns the trees standing in or near infested places will require the same treatment; and, so far as time and funds permit, spraying also will be prosecuted vigorously in the woodland colonies. In the central towns the burlaps will require frequent inspection, and also in all infested sections in the outer towns.

All available resources must be brought to bear in the effort to prevent the farther spread of the gypsy moth, whether locally or to a distance. Every mile added to the outlying border tremendously increases the total infested area and the expense of the work, and the same considerations apply to the establishment of new colonies within the known infested district.

As soon as the gypsy moth egg clusters have been laid, in the late summer, creosoting operations will begin, particularly on those within reach from the ground, in order to prevent them from becoming broken and the eggs from being scattered. Following this, the regular campaign of fall cleaning of gypsy egg clusters and of brown-tail web destruction will be in order.

From time to time the superintendent has freely called upon Prof. C. H. Fernald, Amherst, Mass., for consultation and advice, which has been as freely given. From his position as entomologist for many years to the gypsy moth



Brown-tail moths clustered on electric light pole.
Malden, July, 1905.

committee of the State Board of Agriculture, Professor Fernald is able to express opinions based on a thorough knowledge of the insects, and his counsel has been of highest value.

REPORT OF CONSULTING ENTOMOLOGIST.

A. H. KIRKLAND, Esq., *Superintendent for Suppressing the Gypsy and Brown-tail Moths, Boston, Mass.*

DEAR SIR: — The observations made during the past season in the territory infested with the gypsy moth have convinced me that this insect presents one of the most serious problems confronting the citizens of this Commonwealth. The condition of the infested territory in 1900, at the time the Legislature closed the work of exterminating this insect, was such that only small colonies occurred at intervals over a territory of 359 square miles, and there was every reasonable prospect that it could be exterminated in a comparatively few years.

The gypsy moth has now not only become very generally distributed over the old territory where it is doing a vast amount of damage, but has also extended far beyond its former limits, and at the present time has infested not less than 2,224 square miles, or more than one-fourth of the entire area of the Commonwealth of Massachusetts. This rapid rate of distribution is enough to convince one that, unless the most vigorous measures are taken to control this pest, it will within a comparatively few years be found in every part of this Commonwealth and throughout New England.

The assessed value of the land, exclusive of buildings, in the present infested territory is \$992,860,984, while that in the remaining part of the State is \$272,429,686. In other words, the gypsy moth has already infested over 77 per cent of the land value of the entire State.

One of the most serious problems confronting those in charge of the work of suppression is the forest land in the infested territory. The amount of woodland in the entire State, as given in the last State census, is 1,460,995 acres, and it is valued at \$23,936,362, or \$16.38 per acre. The amount of woodland in the territory already infested with the gypsy moth is 365,265 acres, and is valued at \$9,894,885, or \$27.08 per acre; while the woodland in the remaining portion of the State is 1,095,729 acres, and is valued at \$14,041,470, or \$12.81 per acre.

The cheapest and most successful method known at the present time of destroying the gypsy moths in forests is to cut and burn

all the underbrush and more or less of the trees, leaving the more valuable ones to be burlapped the following season. The cost of this work must necessarily vary according to the nature and condition of the forest; but those who have had the most experience state that the cost in an average forest is not far from \$50 per acre, and to this must be added the expense of putting burlaps on all the remaining trees the following season and killing the caterpillars under them; and all of this work will have to be repeated as often as the forests become reinfested, since, however small their value, they will be a constant menace to near-by premises. This cost of clearing forests is more than three times the average assessed value of the woodlands of this entire Commonwealth, and undoubtedly much more than their intrinsic value. If, therefore, no method can be discovered by means of which the forests can be protected from the ravages of the gypsy moth, the outlook for all owners of woodland in this State is extremely discouraging. If to the expense of clearing and protecting the forests we add that of clearing and protecting the orchards, the nurseries, the gardens, the ornamental trees and shrubs and the public and private parks throughout this Commonwealth, the aggregate annual expense will be enormous.

In view of these facts, it is of the greatest importance that the further spread of the gypsy moth in this State should be prevented, and that such thorough work be done in all the infested cities and towns that there will be very little chance of the escape of moths into new territory. The property of all the land owners in central and western Massachusetts is seriously threatened, and they are powerless to prevent the impending invasion unless the State comes to their assistance and insures them against loss from the depredations of the gypsy moth. This can be done only by direct appropriations for the suppression of the pest. It would be hard to say at this time what annual appropriation by the State, together with that required by law from the infested cities and towns, would be necessary to prevent the insect from spreading into central and western Massachusetts; but suppose those in charge should find, as the work goes on, that it would be necessary for the State to make an annual appropriation of \$200,000, what part of this would a land owner in the uninfested part of the State have to pay?

The taxable property in this State, as given in the last Manual of the General Court of Massachusetts, page 235, is \$3,420,197,428. If this amount of property be assessed for \$200,000, the tax on \$1 would be a little less than one-seventeenth of a mill ($\$0.000\frac{1}{17}$); and a man owning taxable property to the value of \$5,000 or a

farm of that value would have to pay a tax of \$0.294, which might be regarded as a premium paid to the State to insure him against the ravages of the gypsy moth. This is far less than one would have to pay for clearing the moths from a single apple tree. If this same tax should be continued for forty years, as long as a man would be likely to have charge of a farm, his premiums for that time would amount in all to \$11.76, — a much smaller sum than would be required to clear this pest from a small orchard in a single year.

It is therefore by far the wisest policy for all land owners to insist that the necessary appropriations be made for suppressing the gypsy moth, and that the work be carried on in the most approved and economical manner, but at the same time in such a way as to insure success.

The brown-tail and gypsy moths differ so much in their habits that they should be considered separately. The female brown-tail moth flies very freely, while the other does not fly at all; and this enables the former to become distributed far more widely in the same length of time than the latter. The young caterpillars of the brown-tail moth are gregarious, and hibernate in winter tents on the twigs of trees, where they can be easily seen and removed at any time during the winter. They are therefore more easily destroyed than the gypsy moth, and, as they feed on a much smaller number of kinds of trees and shrubs, they have never caused so much damage as the gypsy moth.

The caterpillars of the brown-tail moth during the latter part of their existence before pupating are furnished with exceedingly minute nettling spines in innumerable numbers which are freely scattered, and when they come in contact with the human skin they cause an intolerable itching and a most unpleasant sensation such as no one can appreciate until he has had the experience. This feature of the brown-tail moth brings it very forcibly to the attention of people whose premises are infested, and gives this insect a greater notoriety than has been gained by the gypsy moth.

Much has been said and written about the importation of parasites, and great hopes have been entertained that parasites might be found which would destroy both the gypsy and brown-tail moths.

While the work of extermination was going on during the nineties, I was not in favor of importing parasites, for the reason that in working for extermination the caterpillars containing parasites might be killed, and in this way many and perhaps all of the

imported parasites would be destroyed; but I repeatedly expressed the opinion before the legislative committees, that, if the work for extermination should stop, it would be of the greatest importance to make a thorough and exhaustive investigation of the subject of parasites and to import such as would destroy these two moths.

The work of importing parasites is not so simple a matter as one might suppose, and should be undertaken only by a skilled entomologist. This work was begun last summer, and we were so fortunate as to enlist the services of Dr. L. O. Howard, chief of the Bureau of Entomology of the Department of Agriculture, Washington, D. C., one of the foremost entomologists in the world, and one who has probably given more real scientific study and investigation to the subject of parasites and parasitism than any other living entomologist. Dr. Howard visited Europe last summer for the express purpose of studying the parasites of the gypsy and brown-tail moths, and of making arrangements for successive shipments of them during the year; and it is to be hoped that he will be able to go over again next summer and continue the work he has begun with so much energy.

It is not to be expected that foreign parasites, even when successfully introduced, will produce results at once, for it will take time for them to multiply and increase to such an extent as to materially reduce the number of the caterpillars upon which they feed. It is not even certain that the parasites of these two insects when brought to this country will accomplish the purpose for which they were imported. This work is entirely experimental, but it is certainly desirable to give it a faithful trial. In the mean time, every effort should be made to suppress these moths and prevent their spread into the uninfested parts of the State; so that, if the parasites fail in their work, these insect pests may be kept within their present limits rather than scattered over the entire State.

I am glad to know that it is the purpose of the present management to thoroughly investigate this matter of importing parasites and to adopt every possible means for their successful introduction.

Respectfully submitted,

CHARLES H. FERNALD.

AMHERST, MASS., Dec. 15, 1905.

WORK AGAINST THE BROWN-TAIL MOTH.

The work against the brown-tail moth webs began in several cities and towns about November 20, and by December 1 the foliage had fallen sufficiently to permit of general



Pears and apples covered by brown-tail moth webs. September, 1905. Care should be used to clean such fruit before it is shipped.



work against this insect. During the month of December the removal of brown-tail moth webs on shade trees was actively carried on, while at the same time the egg clusters of the gypsy moth high up in the trees were destroyed by the same gangs, thus economizing labor. The mild weather of the fall caused the leaves on apple trees to remain until well into the month of December, and thus delayed in a marked degree the work on private estates; however, throughout the entire month many thousand property owners were diligently engaged in destroying webs.

At this point it may be well to mention a common error made by citizens and contractors in removing webs, particularly on pear trees. In far too many cases the entire tops of the trees have been cut off, leaving large, unsightly stumps, seriously injuring the trees and shortening their lives. On general principles it would be better, if this practice is to be adopted, to cut the trees down at once, rather than to leave them to decay or become matted with an unsightly growth of branches.

Since the brown-tail moth has now become so thoroughly established, and promises to be a permanent resident, it will be well for property owners in the future to so prune young fruit trees as to induce a low heading. Trees which have been grown with a low head, aside from the obvious advantages of ease of spraying and picking the fruit, are much more readily freed from the brown-tail moth webs than those which have been allowed to run up to a high head.

Another matter worthy of the careful attention of those who are planting fruit trees in the village house-lot garden is the wisdom of using dwarf stocks. At the present time many desirable varieties of pears and apples can be produced on dwarf trees. It is a well-known fact that such trees yield fruit of superior size and quality, take up less room, allow for a greater number of varieties in the garden, and, in addition, — which seems highly important, from our standpoint, — can be easily cleared from the brown-tail and the gypsy moth.

One of the most alarming features connected with the destruction of the brown-tail moth is the fact that nearly all the

nurseries in eastern Massachusetts have now become infested. While the system of nursery inspection has been carried on efficiently under the direction of Dr. H. T. Fernald, and while nurserymen, as a rule, show a disposition to suppress the moth on their property, at the same time there is great danger that a few nests may be overlooked in shipping out nursery stock, and that in this way the insect may become distributed over a wide area. It would not be a matter for surprise if the brown-tail moth is found at any point in the eastern United States.

As affording an idea of the abundance of the brown-tail moth, even in limited areas, where conditions favor the increase of the insect, the figures given by William Allen, assistant superintendent, Mount Auburn Cemetery, Cambridge, are of interest. During the winter of 1904-05 Mr. Allen removed from the trees in the cemetery 700 bushels of brown-tail moth webs, averaging 330 webs to the bushel, or a total of 231,000 webs. Estimating these at the average figure of 250 caterpillars per web, we have 57,750,000 caterpillars destroyed by this operation.

WORK BY OTHER STATE BOARDS.

A considerable amount of land in the infested district is under the control of the Metropolitan Park Commission and the Metropolitan Water and Sewerage Board, while along the State highways the roadside trees are now under the care of the Massachusetts Highway Commission. All these boards have endeavored to co-operate with the State superintendent and with the local authorities in the work of suppressing the moths, and a brief summary of their operations to date is given in the following correspondence:—

METROPOLITAN PARK COMMISSION,
BOSTON, Jan. 12, 1906.

Prof. A. H. KIRKLAND, *Superintendent for the Suppression of the Gypsy and Brown-tail Moths, 6 Beacon Street, Boston.*

DEAR SIR:—The Metropolitan Park Commission presents herewith a summary of the work done against the gypsy and brown-tail moths during the past year in the reservations and parkways under its care and control, and of the work contemplated during

the present year, and first wish to thank you for your kind assistance with information, advice and inspection, and your offer of work in the neighborhood of the reservations and parkways, intended to protect them from incursions of the moths.

During the winter and spring of 1905 a considerable amount of tree and brush cutting and burning over of the ground was done at the spots of most serious infestation in the reservations. This cutting had for its primary purpose facilitating the work of repression of the moths, and incidentally improvement of the tree growth and of the landscape. The result was necessarily injurious to the landscape where the ground was burned over and brush temporarily destroyed. In these same regions and along the parkways the gypsy moth nests were creosoted, and at some points auxiliary spraying was done during the summer. The result was satisfactory in the regions where the work was done, but the amount of the appropriations did not permit its being extended over an entire reservation; and therefore, although the work was carried to the full extent of the funds appropriated, did not prevent the spread of the moths to other parts of the reservations, especially in the Middlesex Fells.

A careful review of the situation in the early autumn made the commission feel that it would be possible, with such appropriations as might reasonably be expected for its maintenance, to care for the reservations and parkways except Blue Hills and Middlesex Fells either with its own forces or through contractors, and, in either case, with your advice and inspection. In the Blue Hills we were advised by you that gypsy moth colonies had been found in various parts of the deep woods. As the necessity for work against these pests had not been known to exist, and the superintendent and forces in the reservation had no experience in the work against them, it was deemed wise to ask you to supervise the immediate measures of repression which appeared absolutely necessary. You very kindly assigned to the work a manager whom you stated to us you considered to be one of your most experienced and reliable men. In the Middlesex Fells it was also decided, in conference with you, that, as work had already been done by our forces under special appropriations for that purpose, it was wise to continue the work, omitting therefrom certain operations which had a tendency to unduly affect the landscape, such as burning over the ground cover, and substituting therefor other measures equally effective. This work has continued energetically since September, with the result that almost the entire reservation has been cleared of weak sprout growth and tall growths of sorts which are non-

flowering, or which have little value for their foliage. It is needless to say that the completion of this work has immensely reduced the difficulty and expense of the more direct kinds of work against the moths throughout the reservation, has rendered it more accessible and useful to the general public, and will also be a help to the vegetation. In addition to this brush cutting a limited amount of tree cutting has already been done, and will, if possible, be continued during the winter, with a view to removing trees of minor value, those which are badly diseased or broken, and those which are crowding more valuable trees so as to be an injury to their growth. This work will be conducted very carefully, and will necessarily be limited to removing no more trees than will still leave the forest-like appearance of the reservation, even though it be necessary to leave standing more trees than perhaps the forester or the gypsy moth antagonist would advise.

In addition to the above work, which is merely preliminary work intended to facilitate the actual destruction of the eggs and moths themselves, creosoting of the nests of the gypsy moth was begun, first, at your suggestion, on the trunks of the trees along the roadsides, paths and picnic grounds much frequented by the public, and next of the nests found on the ground, rocks and trunks of trees to a height likely to be covered by snow during the winter, on a strip along the borders of the reservation 150 feet wide. As this work was finished, the creosoting of other nests upon trees or plainly visible upon the rocks and ground over a strip of 500 feet wide along the entire border was begun, and has now been largely completed. It is the wish of the commission to continue this creosoting work over the entire reservation, so that, in addition to the border strips, tree work shall be completed throughout the reservation, and both ground and tree work shall be completed in such sections as contain the most valuable conifers. It is the intention of the commission, if funds are provided for that purpose, to band the trees for a broad strip along the borders of the entire reservation on the principal highways, and, if possible, throughout the seriously infested portions of the district. It is also the desire of the commission to spray at least the borders of the reservation, and of sections containing the most valuable coniferous trees and the most seriously infested sections of the reservation. It is also the desire of the commission to use oiled hay and other means of preventing the caterpillars from leaving the reservation.

The work above outlined could not be begun last year until the special appropriations for maintenance became available late in February. These appropriations were exhausted in September;

but, in view of the fact that the State had authorized you to superintend the carrying on of extensive work in the territory outside the reservations, it was deemed wise to begin the work, at the expense of other funds not primarily intended for this purpose, in September last, with the result that we are now farther along with the work than we have ever been in any previous year. At the same time, it will hardly be possible to continue this work out of these funds beyond the time when the Legislature shall decide what maintenance appropriations shall become available for this year. We shall therefore be obliged to ask for a large special appropriation this year, and we deem the matter so important that, when it is under consideration, we trust you will, if possible, appear before the committee and give your testimony in regard to the character of the work being done and the advisability of the appropriation.

Again thanking you for your kindly interest and assistance, I remain,

Very respectfully yours,

(Signed) W. B. DE LAS CASAS,
Chairman.

METROPOLITAN WATER AND SEWERAGE BOARD,
BOSTON, MASS., Jan. 5, 1906.

Mr. A. H. KIRKLAND, *Superintendent for Suppressing Gypsy and Brown-tail Moths, 6 Beacon Street, Boston, Mass.*

DEAR SIR:—In response to your request I send you a brief description of the work done by the Metropolitan Water and Sewerage Board in protecting property under its charge from the ravages of the gypsy and brown-tail moths. This work has been confined mainly to the property around Spot Pond, although considerable work has been done on property at Mystic Lake and the Mystic pumping station, and at the Chestnut Hill reservoir.

The land around Spot Pond belonging to the Board comprises about 200 acres, all of which is infested to a greater or less degree with both gypsy and brown-tail moths. For the double purpose of improving the character of the wooded areas and of reducing the number of trees to be protected, a large number of trees on the thickly wooded areas have been cut down. Between Feb. 24 and July 21, 1905, about \$5,000 was expended in protecting the remaining trees by applying creosote to the egg clusters of the gypsy moth, placing bands of burlap and also of Tanglefoot around the trees, and by spraying the foliage with Disparene. Nearly all of this sum was expended in protecting about 80 acres of land, most of which was badly infested with gypsy moths. All

egg clusters on the trees and grounds were carefully painted with creosote, but a large number of caterpillars appeared in the spring from off the ground, due, probably, to broken egg clusters accidentally scraped from the trees which were cut down during the winter. Tanglefoot was applied to each tree as soon as the new caterpillars were discovered, but not soon enough to prevent thousands from getting into the trees. From May 12 to July 21 the trees were sprayed with Disparene, the plant used for the work being a ten horse-power portable steam boiler; a single acting steam pump; two 300-gallon tanks, in which the Disparene was mixed in the proportion of 10 pounds to 100 gallons of water; and 1,000 feet of one-inch and three-quarter-inch wrought-iron pipe, to which was connected seven lines of one-half-inch rubber hose, fitted with double spraying nozzles. At several points windrows of hay sprinkled with gas oil were used, to prevent the caterpillars from entering our property from the surrounding land which had not been protected.

As a result of these measures, the foliage on the trees on the land of the Board was injured but very little, and showed a very marked contrast from that on adjoining property. The number of gypsy moth egg clusters to be destroyed on this area during the coming season is comparatively small, and by a prompt application of Tanglefoot it is expected that but little spraying with Disparene will be required during the coming season.

The land west of the pond is now badly infested with both gypsy and brown-tail moths, and a force is at present employed in painting the egg clusters with a mixture of equal parts of creosote and gas oil, and cutting off and burning the nests of the brown-tail moths. This work was commenced November 20, and up to January 1 about \$1,300 had been expended.

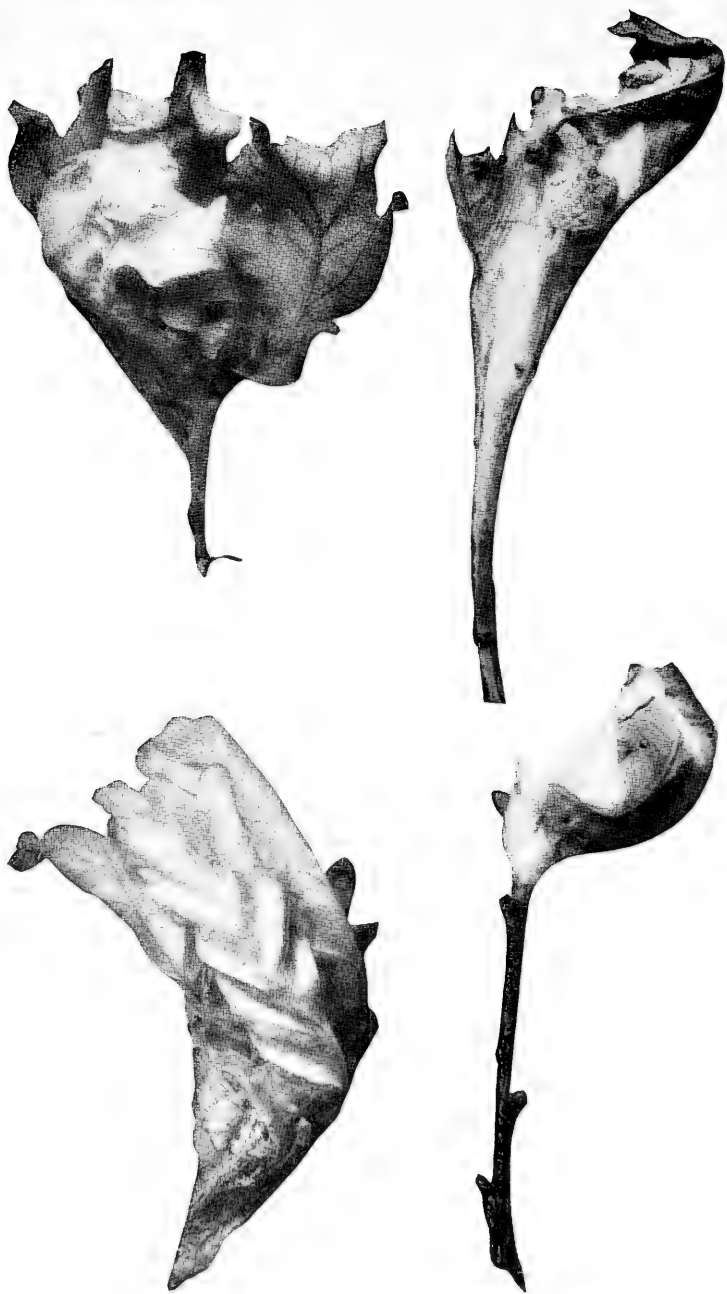
The total cost of work on the Spot Pond property, exclusive of the work of cutting trees, was \$6,300 for the year. Work of a similar character at Mystic Lake pumping station and reservoir has cost about \$700, and at Chestnut Hill reservoir \$500, making a total of \$7,500 expended during the year in protecting trees on the property in charge of the Board.

Some of the land of the Board in Marlborough, Southborough and Framingham is infested with brown-tail moths, and a few clusters of eggs of the gypsy moth have been found in Weston, Wayland and Framingham.

Yours very truly,

(Signed) DEXTER BRACKETT,

Engineer Sudbury and Distribution Departments.



Winter webs of brown-tail moth on oak.

MASSACHUSETTS HIGHWAY COMMISSION,
BOSTON, Jan. 1, 1906.

Mr. A. H. KIRKLAND, *State Superintendent for the Suppression of Gypsy and Brown-tail Moths, 6 Beacon Street, Boston, Mass.*

DEAR SIR:—The Acts of 1905, chapter 279, gives the Massachusetts Highway Commission exclusive care and control of all shade trees within the limits of the State highways.

The records in the office of the Superintendent for the Suppression of Gypsy and Brown-tail Moths show that there are approximately 80 cities and towns in which State highways are located where the pests have been found. It is probable that the trees on the State highways in many of the towns are not infested, although colonies may have been found within the municipal limits.

The reports of the engineers of the commission indicate that in most of the towns the moths have not yet made much progress, but that in a few instances, notably the State road from Stoneham to Lawrence and the State road from Arlington to Burlington, the trees are badly infested by both pests.

The commission intends to suppress the moths wherever they may be found within the State highway locations, and several contracts have already been let, with this end in view. Work is already in progress on the roads before referred to as being badly infested, under a contract with a private firm of contractors. All other contracts thus far made have been with the local authorities. In the opinion of the commission, it is probable that most of this work will be done in this manner, for the reason that the municipal officers are already at work with organized forces on the town roads, and it is thought that the State highway work may be done more economically by them in connection with the town work than by outside contractors.

Yours truly,

(Signed) A. B. FLETCHER,
Secretary.

At the Danvers Asylum and also at the State Hospital in Tewksbury, both properties being infested by the gypsy and brown-tail moths, operations to suppress the pests are under way.

At the United States reservation at Nahant, owing largely to the activities of Mr. George Abbot James, tree warden, the badly infested area is being thoroughly cleared. At the United States naval nitre depot, Malden, and also at the various fort reservations along the harbor front, the authori-

ties in charge are now at work destroying the egg clusters and nests of the moths, while equally good work is under way at the United States arsenal at Watertown. In short, all State and national boards, whose attention has been called to the matter, have shown a most helpful desire to do their share in suppressing these pests on the property under their care.

IMPORTING NATURAL ENEMIES.

The Legislature of 1905 provided for the expenditure of \$10,000 a year for three years for the investigation and importation of parasites and other natural enemies of the moths. It is a well-established fact that in Europe, where the gypsy and brown-tail moths are natives, outbreaks of these insects are checked in a few years by their natural enemies. While it is perfectly true that at intervals these pests show themselves as terrific plagues, yet in a short time the "balance of nature," as scientists call it, asserts itself, and they subside as a result of the attacks of the natural enemies. For many years it has seemed most desirable to investigate the enemies of the two moths in Europe, and to import those which promise to be of the greatest assistance in combating the pests. The broad view taken of this problem by the Legislature, as shown by the legislation above mentioned, has made possible a thoroughgoing effort along these lines.

Following his appointment, the present superintendent, with the approval of His Excellency the Governor, went to Washington, and by arrangement with the Honorable Secretary of Agriculture, Mr. James Wilson, was enabled to secure the co-operation and services of Dr. L. O. Howard, chief of the Bureau of Entomology of the United States Department of Agriculture. At the instance of the Hon. Ernest C. Roberts of the seventh congressional district, the last Congress had already made a small appropriation for the purpose of investigating parasites of the moths. With the larger sum made available by the Massachusetts Legislature, it was possible to lay out comprehensive plans for the importation of desirable parasites.

Dr. Howard went abroad in the interests of this work early last summer, and succeeded in organizing a chain of

trained agents, men of recognized standing as entomologists, extending from southern Italy through Switzerland, Austria, Germany and France. Since that date all these different agents have been busily engaged, so far as their opportunities would permit, in collecting parasites of the moths and forwarding them to the superintendent.

The State of Massachusetts is particularly fortunate in securing the assistance of a man of Dr. Howard's high scientific attainments, experience in importing parasites of injurious insects and thorough knowledge of European conditions. For years he has been in touch with European entomologists, and has placed them under a great many obligations. We are thus able now to take advantage not only of his technical knowledge but also of his personal acquaintance with scientists abroad, which has already been of great value.

Through the courtesy of the Hon. G. H. Lyman, collector of the port of Boston, and Mr. G. A. Hibbard, postmaster, Boston, shipments of parasites arriving by either express or mail have been promptly received. The most numerous sendings have, however, come via the port of New York, and to facilitate their prompt forwarding the Honorable Secretary of Agriculture issued the following regulation:—

REGULATION I.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY, WASHINGTON, D. C., Nov. 21, 1905.

Under authority of section 3 of the act of Congress approved March 3, 1905 (33 Stat., 1269), it is ordered that packages containing parasites of the gypsy moth, parasites of the brown-tail moth, parasitized gypsy moths and parasitized brown-tail moths, or any of them, when addressed to A. H. Kirkland, 6 Beacon Street, Boston, Mass., U. S. A., or to the Superintendent for Suppressing the Gypsy and Brown-tail Moths, 6 Beacon Street, Boston, Mass., U. S. A., may be shipped, until otherwise ordered, from any European country into the United States, entry to be made either through the port of Boston or the port of New York.

Done at Washington, this twenty-first day of November, 1905.

Witness my hand and the seal of the Department of Agriculture.

JAMES WILSON,

Secretary.

As a result of this co-operative work, the State superintendent has received from abroad several hundred parasites of the gypsy moth, while at the present time nearly every steamer brings a consignment of brown-tail moth webs containing parasites. During December many thousands of these webs were received and forwarded to the Saugus laboratory. People who have suffered from the brown-tail moth plague will find consolation in the fact that in Europe this pest is said to be extensively parasitized in the web stage, although in this country the webs are practically free from attack. The superintendent is very hopeful that from the imported webs there will be developed a large swarm of beneficial parasites, which will help in the work of suppressing the brown-tail moth.

As soon as the field work of the summer of 1905 was under way, a temporary scientific laboratory was established at Malden, and a careful search made for a suitable location for the permanent laboratory for propagating parasites. The importation of parasites is but one feature of the experiment. The insects, after arrival, must be carefully sorted, reared, propagated and disseminated. A careful watch must be kept at all times to detect and destroy any secondary parasites.

It was desirable to locate the laboratory in a section thoroughly infested by both moths, so that there might be available at all times plenty of material for food for the parasites. It was also necessary to secure a considerable area of land which could be controlled for use in out-door experiments. It was decided, as a measure of economy, to lease a small farm with buildings, and after considerable search such a place was found in North Saugus. This locality, while easily accessible by electric cars, is sufficiently isolated to escape any marked visitation from curiosity seekers and others who might accidentally or intentionally disturb experiments in progress. We were fortunate in securing a house large enough to give ample room for use as a laboratory, and at the same time to furnish dwelling rooms for the entomologist in charge of the work. Thus the man who is responsible for the care and rearing of the parasites is at all times on the ground, and can give them

the necessary attention and protection from injury. In the immediate vicinity is a chain of large woodland colonies of the gypsy moth, and near by are numerous orchards infested by the brown-tail moth, as well as a considerable area of scrub oak land where the latter insect occurs in large numbers.

The part of the building needed for laboratory purposes has been fitted up with shelves, tables, breeding-cages, jars and other necessary supplies. Arrangements have also been made for the use of a certain number of fruit trees near by, which will be covered next season with tents of mosquito netting to serve as out-door breeding-cages for the parasites.

For the work of rearing these insects we have secured the services of Mr. F. H. Mosher, a well-trained entomologist, who for several years was associated with the writer in the scientific work of the former gypsy moth committee. We also made use, during the summer season, of the services of two students of the Massachusetts Agricultural College, Messrs. E. A. Back and O. L. Clark, who had received special training in entomological work.

Until spring the parasites received at the laboratory will be kept in cold storage, but as soon as the warm weather brings out the brown-tail or gypsy moths they will be turned loose in cages enclosing trees infested with the moths, where they will have ample opportunity to propagate. It is hoped that a sufficient number will thus be obtained to permit of distribution in infested districts.

RECORD OF IMPORTATIONS.

The following is a record of the material received to December 15, with data concerning each shipment. As might be expected, the insects arrived in varying conditions. Early sendings from some of our correspondents were in paper boxes, and these were badly crushed in transit. Where tin boxes were used, particularly in the case of living insects, the moisture could not escape, and the insects were as a rule dead and often decayed. The best results in sending living insects were obtained by packing in wooden boxes

with a little dry sphagnum moss. In all cases the specimens packed in wood came through in the best condition. The following is a list of material, by countries:—

Japan.

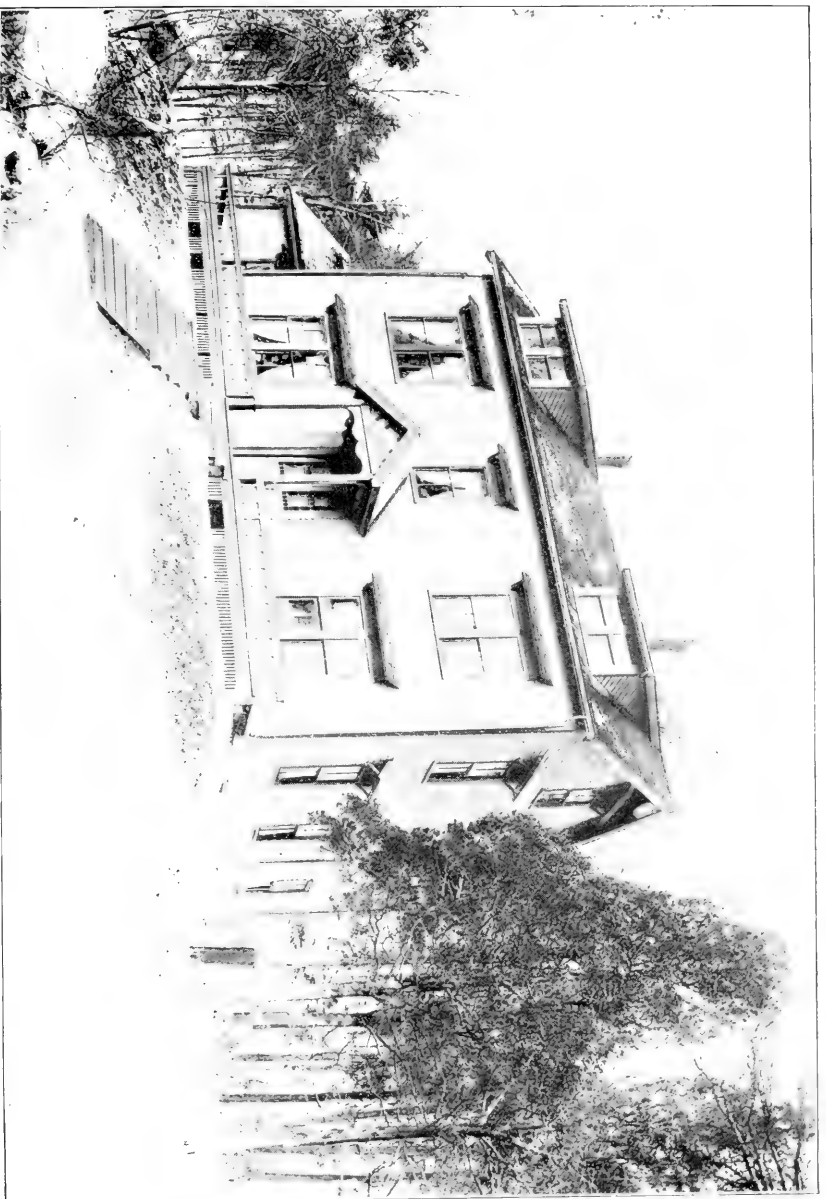
1. Received June 28, 1905, from the Rev. H. A. Loomis, Yokohama, a small wooden box, containing: 11 small dipterous pupæ; 15 medium lepidopterous pupæ. No flies have emerged as yet.

2. Received July 5, 1905, from Prof. S. V. Kuwana, Imperial Japanese Department of Agriculture, Tokio, through the Hon. Lloyd C. Griscom, American minister, a large wooden case with wire gauze sides, containing a small tree on which had been placed a number of infested gypsy moth caterpillars. Another case of small elms was shipped with the insects, and they were thus supplied with fresh food from time to time as far as Honolulu. Most unfortunately the case shrunk somewhat in transit, and nearly all the parasites emerged and escaped *en route*. The net results were: 75 empty *Apanteles* cocoons; 2 living Tachinids, died without laying; 1 living gypsy moth larva, not parasitized; 20 dead gypsy moth larvæ and pupæ, not parasitized; 34 living gypsy moth pupæ, not parasitized; 2 living gypsy moth imagoes; 1 lepidopterous cocoon, Tortricid; 1 lepidopterous pupa; 1 case of *Coleophora* (?); 7 cocoons of *Bucculatrix* (?); several Chrysomelids and fungous gnats. The case and the gypsy moths which were removed were kept under observation for several weeks, but no parasites developed; material still on hand.

Austria.

1. Received July 15, 1905, from Fritz Wagner, Vienna, 2 small wooden boxes, containing as follows: 3 dead *Apanteles*; 12 *Apanteles* cocoons, from which secondary parasites emerged and were destroyed; 17 brown-tail moths, dead; 6 brown-tail moth pupæ. Material on hand at laboratory.

2. Received July 22, 1905, from Fritz Wagner, 3 pasteboard boxes, which contained: 25 gypsy moths; 3 gypsy moth pupæ; 19 brown-tail moths; 6 brown-tail moth pupæ;



Building used as laboratory for propagating parasites. Saugus, December, 1905.

4 brown-tail moth egg masses; 1 dipterous pupa, has not emerged. Material at laboratory.

3. Received July 24, 1905, from Fritz Wagner, 3 wooden boxes, containing: 18 living gypsy moths; 21 dead gypsy moths; 10 gypsy moth pupæ; 5 dipterous pupæ in vials. One male gypsy moth emerged July 26 and 2 females July 28. No parasites have emerged as yet. Material at laboratory.

4. Received July 26, 1905, from Fritz Wagner, 2 wooden boxes, containing: 9 dead gypsy moths; 1 living gypsy moth; 9 gypsy moth pupæ; 1 dead gypsy moth larva. Apparently contained no parasites. Material at laboratory.

Germany.

1. Received July 26, 1905, from E. Schöpfer, Dresden, 2 wooden boxes, containing: 22 gypsy moth pupæ; 1 gypsy moth larva, dead; 3 gypsy moths; 48 Tachinid pupæ. No parasites have emerged. Material at laboratory.

2. Received July 27, 1905, from E. Schöpfer, 5 wooden boxes, which contained: 53 gypsy moth pupæ; 7 gypsy moth larvæ, dead. No parasitic material was obtained from this shipment.

3. Received July 31, 1905, from E. Schöpfer, 4 wooden boxes, containing: 22 gypsy moth pupæ; 1 gypsy moth larva, dead; 3 Tachinid pupæ. Material at laboratory.

4. Received July 31, 1905, from E. Schöpfer, 18 wooden boxes, containing: 387 gypsy moth pupæ; 1 gypsy moth larva, dead; 8 Tachinid pupæ. No further parasites were obtained, and no flies have emerged. Material at laboratory.

5. Received Aug. 7, 1905, from E. Schöpfer, 5 wooden boxes, containing 78 gypsy moth pupæ, from which no parasites were obtained.

6. Received Aug. 9, 1905, from E. Schöpfer, 12 wooden boxes, containing: 303 gypsy moth pupæ; 1 Tachinid pupa. The Tachinid fly emerged August 11 and died August 14. No other parasitic material was obtained from this shipment.

7. Received Aug. 18, 1905, from E. Schöpfer, 1 wooden box, which contained: 65 gypsy moth pupæ; 2 Tachinid pupæ. No flies have emerged. Material at laboratory.

Switzerland.

1. Received July 27, 1905, from Miss Marie Rühl, Zürich, 6 boxes containing: 65 gypsy moth pupæ; 7 live gypsy moths; 1 gypsy moth larva; 1 dipterous pupa; 2 dipterous pupæ in alcohol; 25 microgaster cocoons. One female gypsy moth emerged July 30; no further developments. Material at laboratory.

2. Received July 31, 1905, from Miss Marie Rühl, 5 boxes, containing: 119 gypsy moth pupæ; 7 Tachinid flies, dead; 2 live Tachinid flies; 4 dipterous pupæ. The 2 live Tachinid flies which had already emerged at time of arrival were placed in a jar with gypsy moth larvæ and with leaves, but died without laying. One Tachinid fly emerged from the dipterous pupæ on August 8 but died August 11 without having had an opportunity to mate. Material at laboratory.

3. Received Aug. 5, 1905, from Miss Marie Rühl, 16 boxes, containing: 109 gypsy moth pupæ; 42 dipterous pupæ; 3 dipterous pupæ in alcohol. Two female gypsy moths emerged August 8, 2 August 9 and 3 August 10. One Tachinid fly emerged August 12, and was placed in a jar with a Tachinid fly from Germany. They were not seen to mate, and on August 14 the Swiss fly died without laying.

4. Received Aug. 7, 1905, from Miss Marie Rühl, 6 boxes, containing: 47 gypsy moth pupæ; 3 dipterous pupæ; 400 brown-tail moth egg masses. One female gypsy moth emerged August 7 and 1 August 8. The brown-tail moth egg masses came in an ordinary cigar box. As all the eggs had hatched by the time the shipment arrived, the box and its contents were burned to prevent the escape of the caterpillars. Material at laboratory.

5. Received Oct. 24, 1905, from Miss Marie Rühl, 3 small boxes, containing: 55 Tachinid pupæ; 6 pinned Tachinids; 6 pinned Ichneumonids.

Italy.

1. Received July 15, 1905, from Dr. Gustavo Leonardi, Portici, 7 boxes, containing: 16 gypsy moth pupæ; 63 dipterous pupæ; 137 dead Calosomas; 1 live Calosoma. The single live Calosoma lived twenty-seven days, and devoured

on an average each day 4 nearly mature gypsy moth larvæ. Material at laboratory.

2. Received July 26, 1905, from Dr. Gustavo Leonardi, 24 boxes, containing: 727 gypsy moth pupæ; 221 gypsy moths; 394 dipterous pupæ; 73 *Chalcis flavipes*; 18 dead Tachinids; 3 live beetles; 6 dead beetles; 37 dead Calosomas; 5 *Apanteles* cocoons; 2 dead *Theronia*; 3 Forficulas. Thirteen specimens of *Chalcis flavipes* emerged from the gypsy moth pupæ within three days after the arrival of the shipment, and 9 others emerged from the dipterous pupæ. All the Chalcids were placed in a large jar, together with food and gypsy moth larvæ. Although constantly watched, they were not seen to mate or lay eggs. By the end of a week they were all dead, and were placed in the collection together with the rest of the miscellaneous material noted in the table. The "live beetles" and "dead beetles" of the table were not Calosomas.

3. Received Aug. 1, 1905, from Dr. Gustavo Leonardi, 7 boxes, containing: 46 gypsy moth pupæ; 91 dipterous pupæ; 41 Calosomas. Material at laboratory.

Aside from the 32 specimens of *Chalcis flavipes* which emerged from the second shipment, there were no further developments.

The Italian shipments were rich in the number of very large Tachinid pupæ which they contained. Of these great hopes are entertained, for the flies will probably emerge next spring.

While in Europe Dr. Howard discovered that the winter webs of the brown-tail moth were often extensively infested by certain minute parasites which destroyed the immature caterpillars. In this country as yet no parasites have been found attacking the caterpillars in their winter webs; and, appreciating at once the importance of importing these beneficial insects, Dr. Howard arranged for the collection and shipment of a large number of the winter webs of the brown-tail moth from various points in Europe. As a rule these sendings have arrived in good order, and we are hopeful that they will yield numerous parasites next spring. Up to December 15 the following consignments have been received: —

Imported Brown-tail Moth Webs.

Received from Marie Rühl, Zürich, November 22, 2 boxes, containing 588 webs of the brown-tail moth. These webs were principally from oak trees.

Received November 28 from the same party 10 boxes, containing 3,494 winter webs.

Received from A. J. Cook, Berlin, November 29, 192 webs.

Received from Marie Rühl, December 5, 1 box, containing 1,012 webs.

Received December 5, from E. Schöpfer, Dresden, 1 box, containing 383 webs.

Received from Marie Rühl, December 7, 7 boxes, containing 4,035 webs.

Received from Marie Rühl, December 13, 5 boxes, containing 4,667 webs.

All these webs are now in cold storage, and will be carefully examined next spring; and any beneficial parasites obtained from them will be released, in the hope that they may attack the brown-tail moth in the Saugus woodlands.

The work of Dr. L. O. Howard in connection with importing parasites of the gypsy and brown-tail moths is described in detail in an article in the Yearbook of the United States Department of Agriculture for 1905. He has at my request prepared the following brief summary:—

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ENTOMOLOGY, WASHINGTON, D. C., Dec. 30, 1905.

MR. A. H. KIRKLAND, *Superintendent for Suppressing the Gypsy and Brown-tail Moths, 6 Beacon Street, Boston, Mass.*

SIR:—I have the honor to submit a brief report of my efforts during the year to import the foreign parasites of the gypsy and brown-tail moths into Massachusetts.

Respectfully yours,

L. O. HOWARD,

Chief of Bureau.

Immediately upon the passage of a bill making appropriations to the United States Department of Agriculture, which carried an appropriation of \$2,500 for the purpose of studying and import-



Out-door parasite cage. The tree is infested by gypsy moth caterpillars, while the parasites are confined by the wire gauze covering.
Saugus, July, 1905. (Courtesy of Boston "Globe.")

ing the foreign parasites of the gypsy and brown-tail moths, I began a correspondence with Japanese and European entomologists, seeking for their co-operation in the effort. Soon after you were good enough to place me in charge of the foreign work under a State appropriation for the same purpose, and this responsibility was accepted with the permission of the Secretary of Agriculture.

Japanese entomologists, and especially Mr. Kuwana of Tokio, are making an effort to send to this country living specimens of an important egg parasite of the gypsy moth which is said to exist in Japan. The same entomologists and the Rev. H. A. Loomis of Yokohama are endeavoring to send over in living condition and unparasitized a Braconid parasite of the genus *Apanteles* of the gypsy moth. One sending of *Apanteles* was received at Boston during the summer, and this is the only shipment which has reached this country from Japan during the present year.

On the 3d of June I sailed for Europe for the purpose of organizing a systematic search for parasites of these two insects, and to secure, if possible, continuous shipments throughout the breeding season and during the winter of parasitized specimens of both species. My personal acquaintance with the official entomologists of Europe and my long-continued and very friendly official relations with these gentlemen have greatly facilitated my efforts in this direction, and all have expressed a hearty desire to co-operate with the United States government and with the government of the State of Massachusetts in their work. Their personal endeavors have been at our service, and their expert advice has been of much assistance. In many cases they have been good enough to select and recommend agents, who have been paid for their services from the State appropriation. The personal services of the official entomologists, however, have been gratuitous; and in some instances I have been able to repay them for their courtesy by sending abroad American parasites of injurious insects accidentally established in European countries.

The officials who were interviewed and who have placed their services at the disposal of this country are as follows: Dr. Felipe Silvestri, entomologist of the Royal Agriculture Station at Portici, Italy, and his first assistant, Dr. Gustavo Leonardi; Prof. Antonio Berlese, director of the Royal Station for Agricultural Entomology at Florence, and his principal assistants, Drs. Del Guercio and Ribaga; Dr. Anton Handlirsch and Dr. Hans Rabel of the Royal Natural History Museum in Vienna; Dr. Alexander Mocsary of the Natural History and Ethnological Museum in Budapest; Prof. Joseph Jablonowski of the Agricultural Experiment Station in

Budapest; Dr. Heller of the Zoölogical and Ethnological Museum in Dresden; Dr. Arnold Jacobi of the Royal Forestry School in Tharandt; and Dr. Paul Marchal of the Agricultural Experiment Station, Paris. There were engaged as collectors Mr. Fritz Wagner of Vienna, Mr. Edouard Schöpfer of Dresden, Miss Marie Rühl of Zürich and Prof. A. J. Cook of Berlin. In addition to these paid agents and to the official entomologists a number of other entomologists have offered their services gratuitously, and among them especially must be mentioned M. René Oberthür of Rennes, France, who has sent over a large quantity of supposedly parasitized nests of the brown-tail moth.

I attended a meeting of the Entomological Society of France and made a statement of the work to the members, and all of them promised encouragement and assistance. To all agents, volunteer and paid, the same instructions have been given, namely: to send to your address in Boston as many full-grown larvæ and pupæ as possible of both the gypsy moth and the brown-tail moth, packed in small boxes with abundant supply of food, and forwarded by mail.

The average percentage of parasitism in all European countries is very high, and the results of the comparatively few sendings which were started from Europe in June and July indicate that it is a perfectly simple matter to secure the receipt of living parasites in Boston. At the time of my arrival in Europe and of my visit to the different entomologists it was already too late to secure larvæ and pupæ of the brown-tail moth. As I proceeded north from Naples I was everywhere met with the statement that brown-tail moths had already emerged. But with the gypsy moth the case was different. Professor Leonardi was able to secure several thousand full-grown larvæ and pupæ in Sardinia. Mr. Wagner and I collected quite a large number near Vienna, Mr. Schöpfer was able to collect a number near Dresden, and Miss Rühl was able to secure specimens from north Germany. I was unable to find any about Paris. From those gypsy moth larvæ and pupæ thus secured there have been bred six species of parasites since their arrival in this country; of these, the only one which promises results next spring is *Tachina larvarum*, of which we have perhaps 500 living pupæ.

On the statement of Professor Jablonowski of Budapest, that the winter nests of the brown-tail moth contained minute parasites, I have secured the sending over of perhaps 80,000 nests of the brown-tail moth from different parts of Europe, and from these it is hoped that we may breed an abundant supply of parasites the coming spring.

My efforts to import *Calosoma sycophanta* and *Calosoma inquisitor* during the season have failed. Professor Leonardi started 200 specimens from Sardinia, but all were dead on arrival in Boston. This may possibly have been due to the roundabout journey, since they were shipped by mail to London, thence to New York and thence to Boston. Had they gone by direct steamer from Naples to Boston, and especially had they been placed, if not in the ice box, at least in a cool apartment of the steamer, better results would probably have been gained. Although the American *Calosomas* hibernate as adults, and although through our European agents probably 500 European entomologists have been searching for these species since the autumnal frosts, not a single specimen has been found. My earlier attempts to import these species into this country were all failures, but I have every hope that during the coming summer we may be able to succeed. Some three years ago Dr. Yngve Sjostedt of Stockholm carried a number of specimens of the American *Calosoma scrutator* from Washington to Sweden with success, so that it surely must be possible for the European species to make the return journey.

The whole of the European range of both species is now organized with the exception of Russia, and continuous sendings of both species will be received at Boston for the next two years at least. It seems to me that there is every reason to expect success in the establishment of at least some of the European parasites.

FUNGUS DISEASE OF THE BROWN-TAIL MOTH.

During the latter part of June, 1905, several observers reported that a fungous disease had killed a great many brown-tail moth caterpillars. This disease was first reported from Wakefield, but was also found in about a dozen other towns where the caterpillars were plentiful. In many cases an entire tree trunk for several feet would be found covered with the bodies of the caterpillars, attached to the bark by the fungous filaments. This disease also worked to a remarkable degree in the masses of cocoons, from which in some cases but few living pupæ could be obtained.

As soon as the disease was reported, Dr. George E. Stone, botanist, Massachusetts Agricultural College, was called to investigate and experiment with this disease, to determine if it could be made of any practical value in fighting the caterpillars. Unfortunately for this latter part of the work,

the season was so far advanced that but few experiments could be made.

Dr. Stone's report, which also includes the results of certain laboratory experiments by Mr. O. L. Clark, is printed in full herewith:—

REPORT ON SOME FUNGOUS PARASITES OF THE BROWN-TAIL MOTH.

About the middle of June there was discovered at Wakefield by Field Agent J. W. Enwright some pupæ and caterpillars of the brown-tail moth, covered with a whitish growth which appeared to cause many of them to become sickly and die. Casual observations made by Mr. Enwright and others led them to surmise that the whitish growth causing this injury was of a fungous nature.

At the request of Superintendent A. H. Kirkland, I visited Wakefield June 27, 1905, and spent one day looking over the region about Wakefield in company with Mr. F. H. Mosher, laboratory assistant, and made notes in regard to the nature and extent of this injury. At that time the region of fungous infection appeared in its worst form to centre about Wakefield, with more or less evidence of its occurring in Reading, Melrose and Malden; shortly afterwards, however, it was noted quite abundantly at Malden, Revere, Medford, etc. Mr. Enwright first noted the occurrence of the whitish fungous growth and the sickly and dying condition of the pupæ and caterpillars on June 21. At the time I made the examination of the region about Wakefield with Mr. Mosher the amount of infection was quite noticeable. From a large number of nests containing pupæ, which Mr. Mosher and myself examined, I found from 70 to 75 per cent of the pupæ infested with fungi, all of which were either sickly or dead. The number of infected caterpillars lying about on the trees and ground would equal 80 or 90 per cent. This condition of affairs seemed to hold good for much of the immediate region about Wakefield which we examined. An examination about Malden July 1 seemed to show considerable infection of the pupæ and caterpillars in that region, but it was apparently not so general or marked as in Wakefield.

As to the cause for the unusual outbreak of this fungus on the brown-tail caterpillars and pupæ, no doubt one, and perhaps the most important, factor, was the condition of the weather at the time of the first outbreak and following this period. At that time there occurred more or less rain and cloudy weather, which extended over a period of some days. Such conditions are well known to be particularly favorable for the development of many

fungi. A later period of prolonged rain and dampness occurred during the latter part of August and continued until September, which was also the cause of a rather severe outbreak of parasitic fungi affecting plants; and I am informed by Mr. Orton L. Clark, who was at work in the parasitic laboratory at Malden, that numerous cases of the infested fall webs of the brown-tail moth could be observed at Malden, Wakefield, etc., during September following this period of stormy weather and dampness. In this case the white fungus covered the caterpillars located upon the outside of the nests, apparently catching those which were more subject to the inclemency of the weather at that period, since an examination of the caterpillars in the nests at that time showed them to be unaffected.

In the course of our examination of the affected region, made June 27, we obtained considerable material for microscopic study, and material was sent to us at later date. We found most of the external felt-like growths to be of a whitish color, which proved upon microscopic examination to consist of fungous filaments, and subsequently there occurred in most cases a reddish or salmon-colored tint to the fungus. This was more especially noted on the caterpillars which had been dead for a few days. Most of the diseased pupæ examined in the nests showed little or no fungous growth, but after they collapsed the characteristic whitish growth was evident.

The result of our microscopic study of a number of dead caterpillars showed that there were two species of fungi present, one of which will readily grow on agar (.1 per cent acid), and the other will not. We had no difficulty, however, in isolating one of these forms and obtaining pure cultures of the same. This proved to be the reddish or salmon-colored fungus noted above. It would appear to grow very rapidly on agar, and would frequently cover a petri dish in a few days. At first this fungus displayed a white color, and then gradually passed into a light salmon or deeper reddish tint. The microscopic examination showed that it possessed similar branching habits and spore formation to our common green bread mold (*Penicillium*), but in color it was entirely distinct from this. From hanging drop cultures we were enabled to study the fungus in detail and note its habits and the manner of forming the spores. This fungus¹ proved to be a species of *Penicillium*,

¹ We are indebted to Prof. W. G. Farlow of Harvard University, whose critical knowledge and extensive herbarium are unexcelled, for the final identification of this species. Professor Farlow compared the fungus with an authentic specimen from Gosio, and found them to be identical.

and is given by Saccardo as *Penicillium brevicaulæ*, Sacc.¹ The fungus is probably a harmless one, and its occurrence on the dead caterpillars and pupæ was probably incidental and of secondary importance.

Another species of fungus was always present on the diseased and dead pupæ and caterpillars, which proved to be a form of the Entomophthoræ, which includes a class of fungi represented by about half a dozen genera, and largely confined to insects. We did not attempt to secure cultures of this, but were able to examine the same in connection with the dead pupæ, etc.

This fungus proved to be *Empusa aulicæ*, Reichardt, as given by Saccardo,² or *Empusa grylli* in Thaxter's Monograph.³ This species is parasitic on certain insects, and occurs in Europe and the United States. Thaxter records numerous epidemics among grasshoppers resulting from this fungus, and it occurs also on moth larvæ and caterpillars.

In addition to the above fungi, we found in some of our material, taken from the body cavities of the brown-tail pupæ, colonies of bacteria which were quite general and uniform, and appeared of a pure type. These colonies were so uniform and appeared so constantly that they were isolated and cultured in the usual manner; but no attempt was made to establish the identity of the organism with any described forms, since there was no opportunity for ascertaining whether it possessed any pathogenic value in this particular case.

After isolating the bacterial cultures in an absolutely pure form, some experiments were undertaken in the parasitic laboratory in Malden by Orton L. Clark, under Superintendent Kirkland's supervision. It was, however, getting late in the season for experiments with the brown-tail pupæ, since the moths were rapidly emerging. An outline of these experiments follows, together with the results obtained:—

EXPERIMENTS WITH FUNGOUS DISEASES.

- Experiment* *I.* (a) Ten diseased pupæ were placed in a glass jar with 10 normal pupæ. Result: 3 normal pupæ became diseased.
 (b) One diseased pupa was put in a glass with 10 normal pupæ. Result: no change.

¹ Sylloge Fungorum, Vol. IV., p. 84.

² *Loc. cit.*, Vol. VII., p. 282.

³ Entomophthoræ of the United States, in Memoirs of Boston Society of Natural History, Vol. IV., pp. 1-59, 1886-93.

- Experiment II.* (a) Ten diseased caterpillars were placed in a jar with 10 normal pupæ. Result: no change
(b) One diseased caterpillar was put in a jar with 10 normal pupæ. Result: 1 normal pupa became diseased.
(c) Ten diseased caterpillars put in a jar with 10 normal pupæ. Result: 2 normal pupæ became diseased.
(d) Five diseased caterpillars put in a jar with 10 normal pupæ. Result: 1 normal pupa became diseased.
- Experiment III.* (a) Ten diseased caterpillars were put in a jar with 10 normal caterpillars. Result: 9 normal caterpillars became diseased.
(b) One diseased caterpillar was put in a jar with 10 normal caterpillars. Result: 8 normal caterpillars became diseased, 3 of which pupated.
(c) Ten diseased caterpillars were put in a jar with 10 normal caterpillars. Result: 3 caterpillars became diseased.
(d) Five diseased caterpillars were put in a jar with 10 normal caterpillars. Result: no change.
- Experiment IV.* (a) Ten diseased pupæ were placed with 10 normal caterpillars. Result: 7 caterpillars became diseased.
(b) Same as (a). Result: 5 caterpillars became diseased.
(c) Same as (a). Result: 6 diseased caterpillars.
(d) Same as (a). Result: 4 diseased caterpillars.
- Experiment V.* Fifteen diseased pupæ were ground to a powder and mixed with a tablespoonful of water; pear leaves were washed with this mixture.
(a) Five normal caterpillars were placed in a jar filled with treated leaves. Result: all became diseased.
(b) Same as (a). Result: 4 caterpillars became diseased.
(c) Five normal *gypsy* caterpillars were treated as in (a). Result: 1 became diseased.
(d) Same as (c). Result: 1 became diseased.
- Experiment VI.* Same as Experiment V, only elm leaves were used instead of pear.
(a) Five normal caterpillars were put in a jar with treated leaves. Result: 2 became diseased.
(b) Same as (a). Result: 2 became diseased.
(c) Same as (a), only *gypsy* caterpillars were used. Result: 1 became diseased.
(d) Same as (c). Result: no change.

Experiment VII.

Elm leaves were smeared with a bacterial culture prepared by Dr. George E. Stone from diseased brown-tail moth caterpillars.

- (a) Twenty-five normal gypsy caterpillars were put in a jar with treated leaves. Result: 2 caterpillars died.
- (b) Same as (a). Result: 5 caterpillars died.
- (c) Same as (a). Result: 3 caterpillars died.
- (d) Same as (a). Result: 4 caterpillars died.

Experiment VIII.

Elm leaves were treated with a mixture of a pure culture of the fungous parasite prepared by Dr. Stone.

- (a) Twenty-five gypsy moth caterpillars were placed in a glass jar with treated leaves. Result: 1 caterpillar died.

Elm leaves treated with pure cultures of *Penicillium brevicaulis* and fed gypsy caterpillars produced scarcely any effect. On account of the lateness of the season, it was impossible to carry on experiments from pure cultures with the brown-tail pupæ, and the results of the experiments previously noted should not be considered as conclusive.

From what is known regarding this group of insect fungi (Entomophthoræ), we would expect that, when diseased pupæ and diseased caterpillars are brought in contact with healthy ones, infection would result; and that, when leaves are treated with decoctions of diseased caterpillars and pupæ, a certain amount of infection would be likely to take place, since the decoctions would contain the spores of the disease-producing fungus, and if suitable conditions for germination and development were at hand infection would follow.

The condition of the brown-tail pupæ found in infested nests also indicates that the disease is infectious, and the association of diseased forms with healthy ones in a breeding case would undoubtedly produce the same results, providing the conditions were suitable. On the other hand, it might not be improbable that, in selecting what might appear to be healthy pupæ and caterpillars for these experiments, some of them were in an incipient stage of disease, which would modify the results. In most instances, however, where death occurred to the pupæ or caterpillars in these experiments with brown-tail moths, the characteristic white fungus subsequently appeared. The laboratory, however, being dry and the breeding cases not being closed at the top would give rise to conditions which would have a tendency to check the development of fungi. Undoubtedly the prevalence of rain and damp weather

during certain seasons is capable of exerting quite a repressive influence on the brown-tail moth caterpillars and pupæ, and thus renders them more susceptible to fungi.

Dr. A. Y. Grevillius¹ mentions several caterpillars of the brown-tail moth being killed by *Empusa*, during very warm and rainy weather. In one place he states: "The caterpillars were decimated in an important degree again about the middle of June, especially by an epidemic outbreak of *Empusa aulicæ*, Reich., and there were correspondingly few of them to pupate. Their feeding in the following autumn was not very noticeable in this part of the country." And further: "In the feeding time of 1902, on the contrary, notwithstanding the special destruction of the caterpillars by *Empusa aulicæ*, Reich., a tolerably large number of moths emerged from the cocoons, and these laid their egg clusters not only on orchard trees and oaks, but also on a few other trees and shrubs." Occasionally epidemics of more or less severity occur in this State from this fungus in connection with grasshoppers and moth larvæ.

POSSIBLE HELP FROM PARASITES.

Insect parasitism is one of the most interesting subjects in the whole field of entomology. Nearly every insect has enemies of its own kind, remote relatives, they may be called, which prey upon it and attempt to destroy it. Their work is shown in the relative abundance or scarcity of their unwilling hosts. The farmer notices that certain years are "caterpillar years," and that others are not so characterized. The abundance or scarcity of any caterpillar pest depends in large measure upon the presence or absence of the parasites which attack that particular insect. Of course the work of birds is an important factor, but the influence of parasites in the long run controls the situation.

Take the case of the army worm, — a pest of grass and grain fields at comparatively long intervals. This insect is notably attacked by a certain fly which lays its eggs on the "worms," the eggs hatching into grubs which kill their hosts. When the "worms" are abundant, there is offered a wealth of food for the parasite. They multiply prodigiously, destroy their hosts, and in a season the army worm outbreak becomes a thing of the past. The following year there is a

¹ Zur Kenntniss der Biologie des Goldafters. Kempen, 1905.

multitude of parasites, and but little food for them. As a result, the flies die off; and the few remaining army worms increase slowly in swamps and along the banks of streams, until after the lapse of years their numbers are sufficient to lay the foundation for another army worm outbreak, only to be followed by the development of a multitude of parasites to check it. This shifting relationship is an illustration of the "balance of nature," so called, — the tilting adjustment of an insect to its enemies.

The canker worm and the tent caterpillar give equally good illustrations, except that the period of their ravages usually extends over two or three years before it is checked. This is practically what takes place with the gypsy moth and brown-tail moth in Europe. As stated elsewhere, their periodic outbreaks run for a few years and then subside, to reappear after the lapse of several years. The birds figure to a considerable extent in checking these insects, and no doubt several fungous or bacterial diseases are also of service, but the principal check seems to be exerted by parasites and predaceous insects.

But the story does not end with simple or primary insect parasitism. Several of these parasites, particularly the larger ones, when they are safely established in the vitals of their hosts, are attacked in turn by certain minute forms of insect life, — secondary parasites. Then we have an exhibition of the complicated phenomenon of secondary parasitism, which is almost as much to be dreaded as the original attack of the caterpillar; for if the true (primary) parasites are destroyed, the principal check on the caterpillar's development is removed. To differentiate between and sort out the beneficial primary from the highly injurious secondary parasites calls for the highest skill of the well-trained specialist. I have thought it best to go into this matter somewhat at length, so that there may be on record one of the most important difficulties and dangers of the promiscuous importation of parasites of the gypsy moth.

The problem, then, of successfully importing gypsy and brown-tail moth parasites depends on several factors, among which the following are the most important: —

1. To collect in Europe a large quantity of parasites and parasitized nests, caterpillars and pupæ of the moths.
2. To pack safely and ship them so that they may arrive with the least possible delay.
3. To care for the material in such a way that as many parasites as possible may be obtained.
4. Most important of all, to detect and kill every single form of injurious secondary parasites.
5. To propagate the true parasites under the most favorable conditions.
6. To finally liberate large numbers of these parasites in close proximity to the caterpillars which are their natural hosts.

Thus it will be seen that this important work of importing parasites involves a considerable amount of time, as well as painstaking care and the highest technical skill. It cannot be done in a year, nor probably even in two years. It cannot be done by amateurs; it must be done by specialists, working carefully, working slowly, it may be, and taking every possible precaution to prevent failure. No better illustration of how dangerous a thing "a little knowledge" may be can be found than in the flippancy and positiveness with which certain newspaper writers and men well trained in other lines but with hardly a smattering of entomological knowledge discuss this matter and advise how best to proceed. Laymen who would not attempt to advise how to treat a case of pneumonia or interpret a doubtful point of law, are prompt to dictate the course to be followed in one of the most technical and difficult problems in the whole field of entomology.

The practical question for the taxpayer is whether the \$10,000 appropriation per year for three years now available will yield tangible results, or not. To answer this would involve omniscience. The superintendent is hopeful, even sanguine, that in the end the importation of the natural enemies of the moth from abroad may solve successfully the great problem in which we are now engaged. But nature cannot be reduced to a mathematical basis. She is full of surprises. Promising lines of re-

search may be barren of results, while apparent failures may unlock the door to success. All the writer can say is, that the foreign end of the work is in the hands of the man best qualified of any one in this or any other country to carry it to success, and that on our part no effort will be spared to obtain the results we seek. We may succeed, and we may fail. All should regard it as an experiment, pure and simple. Should it be completely successful, five years at least will be required before noticeable results will be obtained. In the mean time, no one should sit idly by and allow his trees to be defoliated and perhaps killed. We must continue to apply the methods that we know will bring results; we must keep up the fight along the lines we know to be effective.

EDUCATIONAL WORK.

Since the success of the work against the moths depends largely upon the intelligent co-operation of property owners, it has been the policy of the central office to disseminate in every possible way information concerning the habits of the insects, and the most efficient means for combating them. To this end, two leaflets describing the moths were reprinted by permission of the Board of Agriculture, and were freely distributed to all inquirers early in the season. By the time these were exhausted the well-illustrated Bulletin No. 1 had come from the press. The bulletin gives in plain language concise descriptions of both moths, their habits, the remedies best suited to destroy them, and a full exposition of the law under which we are working. It has had a wide distribution among city and town officials, women's clubs, village improvement societies and interested citizens throughout the State. A poster describing necessary fall and winter work, and giving colored cuts of gypsy and brown-tail moth nests, has been generally distributed throughout the infested district. Besides being placed in post-offices, stores, etc., these posters, through the courtesy of the large railroad systems entering Boston, have also been placed in numerous railroad stations. In addition to this, the superintendent and his agents, as time has permitted, have given numerous illustrated lectures throughout the moth district before clubs

and other interested organizations. Prof. W. L. Underwood of Belmont has also given a number of most helpful lectures on the moths.

No single feature of this educational work has been more helpful or more gratifying than the cordial assistance received from the press of the State. Our leading newspapers have shown a notable willingness to disseminate timely information concerning the moth pests, and have co-operated with the superintendent in every way in their power, and it is but a pleasure to acknowledge at this time the valuable service which they have rendered. Particularly worthy of mention is the part taken in this work by the Medford "Mercury." This paper, at a large expense and continuing through several issues, published a great deal of valuable information concerning the gypsy moth, and, what was more effective, a large number of excellent half-tone views, showing damage by the insect in Medford and vicinity. These special numbers were widely circulated throughout the State, and called attention to the damage by the moth and the necessity for suppressing the insect in a remarkably effective manner. In December these articles were issued in pamphlet form and widely distributed. This work was made possible through the co-operation of Gen. S. C. Lawrence, who in this way has added to the already long list of his well-known philanthropies.

Since it has been found difficult as well as expensive to send inspectors to work with the local superintendent in each of the outlying towns for a sufficient time to give full instructions in methods of locating and combating the moths, it was finally decided, in the interests of economy as well as a means of education, to hold a field day meeting at Medford December 14. Nearly all the local superintendents were in attendance on this occasion. An opportunity was given all to familiarize themselves thoroughly with the appearance of the egg clusters, winter nests and other evidences of the moths, and to see the actual methods of work as applied on a large scale on the estate of Gen. S. C. Lawrence. Municipal work on the public streets under the direction of Local Superintendent J. D. Dwyer, where men were engaged in

the difficult operation of clearing tall elms of both insects, was also inspected; while later a lecture, with lantern slides showing all stages of the insects, was given by the superintendent. This meeting has proved of great educational value, and has saved much travel and correspondence on the part of the central organization.

DANGER TO PARKS.

In no section of the United States, perhaps, has so much been done for the preservation of woodland areas for the benefit of future generations as in Massachusetts. Large amounts of public and private funds have been invested for the purpose of providing places where the rapidly increasing population can enjoy fresh air and the beauties of lake and wood. Boston early took the initiative in this effort, and its beautiful park system has served as a model for many cities throughout the country. An excellent illustration of park building on a smaller scale is found in Pine Banks Park, on the borders of Malden and Melrose, where the late Hon. E. C. Converse, noted for many philanthropies, devoted to this purpose many acres of land covered with a magnificent growth of white pine mingled with deciduous trees. He expended large sums of money in developing the tract, cutting out roadways and beautifying the surroundings with rare shrubs and beds of flowers, all combined with the art of the experienced forester, to obtain beauty and comfort without detracting from the delights of the wild woodland.

Plymouth has followed, with its still larger area at Morton Park, where the tangled woodland is traversed with well-kept drives and footpaths skirting the shores of Billington Sea and its attendant ponds. Quincy, next door to populous Boston, where a rapidly increasing population is covering its area with buildings, has provided Merry Mount Park, which is being developed as rapidly as the resources of a young city will admit. To the northeast the great Lynn Woods Reservation offers solitude and recreation to thousands each summer.

While these are notable instances, nearly every city and large town in the State has labored to the same end to a greater or less degree. Above all, born of the brain of the late Charles Eliot, is the magnificent scheme of a metropolitan park, with its thousands of acres of wild woodland, intersected with drives and bridle paths and connected by improved parkways, where one may drive for miles with constantly changing vistas of tangled hill and dell. Thus, by the wisdom of our legislators with the hearty co-operation of the citizens, has the city of Boston been surrounded by a chain of parks, where its people can recuperate their energies, breathe the air and observe the beauties of nature at first hand.

A park system without trees is an anomaly. There is no pleasure in visiting a park denuded of its vegetation, showing in summer, instead of refreshing shade, only naked trees, bare fields and rocks exposed to the scorching sun.

A portion of our great park area has already been scourged by the gypsy and brown-tail moths; Lynn Woods has had over 100 acres killed by this means, while a larger area has been defoliated. Many of the stately trees of Pine Banks Park have been killed, and numbers of those which remain are in a dying condition. A hundred years will be required to bring back the former beauty of the place. The vast area of the Middlesex Fells is already thoroughly infested and the southern half has been seriously injured, in spite of the vigorous efforts of those in charge of the park to suppress the pest.

The Blue Hills Reservation has been inspected, and some 50 places discovered where the gypsy moth has obtained a foothold, and a very few nests of the brown-tail moth have been found and removed. The findings here, in most cases, have been of single nests, generally remote from each other, but in a few instances more serious infestations have been found. These offer no special difficulties if promptly and thoroughly treated. This infestation in the largest park south of Boston, and one of particular beauty, while not severe at present, is potentially of gravest significance. This reser-

vation, with its dense growth of oak and other trees, its rocks and ledges, offers the same difficulties to a campaign against the gypsy moth as are found in the Fells, and it is of utmost importance that the pest be wiped out here without delay. If this is not done, the example presented by the area north of Boston shows what the result will be in the future. The insects will gain yearly in increasing ratio, until only a long and most costly campaign can bring them under control, while in the mean time many valuable trees will be killed.

Conifers, stripped of their leaves, will succumb in one year; deciduous trees, with greater recuperative powers, will withstand the ravages for a few years longer; but where the moths are neglected, the ultimate result will be that instead of green trees our wooded parks will be dotted with dead and dying stubs, the expense of removing which may be far beyond the amount now necessary to clean out the insects, or at least to reduce the infestation to a degree where a slight annual expenditure will hold them in check. If our parks are to be preserved, the moths must be fought persistently wherever they occur.

THE WOODLAND PROBLEM.

The examinations made by our inspectors have developed the fact that in nearly all the woodlands in the central infested district the gypsy moth occurs in alarming numbers, while the brown-tail moth is also very much in evidence. This severe woodland infestation constitutes the greatest menace to the successful control of the gypsy moth. So long as the woodlands remain severely infested, it is impossible to keep streets and residential sections free from the pest. These woodland colonies, traversed by roads, boulevards and cart paths, yield in the caterpillar season a multitude of swarming insects, which travel outward in all directions, stripping the foliage as they go. What is more important they drop in large numbers upon passing vehicles, and are thus transported over wide areas, although the effect of the scattering is most noticeable within a few miles of the colonies. Thus the insects are able to reinfest sections from



Pines and other trees defoliated by gypsy moth caterpillars
on property of Walter C. Wright.
Medford, Mass., June, 1905.

which they have been previously cleared. It is practically impossible, for example, to keep the residential sections of Medford or Saugus measurably clear of the gypsy moth while the large woodland colonies flourish but a short distance away.

The funds available under the act, both from municipalities and from the State, are not sufficient to carry on any general campaign against the moth in woodlands. Believing it his duty to present to the Legislature all known facts bearing on the problem of controlling the gypsy moth, the superintendent has had a fairly careful examination made of the woodland colonies, and gives below a statement of their area, as prepared by the assistant superintendent, Mr. D. M. Rogers, who was in charge of this investigation.

In many cases he could not obtain an exact statement of the acreage involved, but so far as possible the figures were obtained from the engineers or assessors of the several cities and towns. Tracts designated as "dangerously infested" are those that may be considered in immediate need of attention to prevent stripping or serious injury by the caterpillars next season. With these tracts there is also the additional danger which will result from the insects spreading into sections not yet badly infested, or, in some cases, swarming on street trees a short distance away. Tracts designated as "slightly infested" are those where the moth has already secured a foothold, but not in sufficient numbers to cause any notable defoliation. Unless the insects are suppressed in these tracts, they will soon become dangerously infested.

At Watertown practically all the woodland, some 50 acres, is dangerously infested. In Waltham 50 acres are seriously infested out of about 3,000 acres, while it is probable that other small colonies may exist there. Belmont has about 450 acres of woodland, all dangerously infested; while at Lexington 1,000 acres may be considered seriously infested, with an equal amount in addition slightly infested. The dangerously infested woodlands at Arlington include about 500 acres and at Winchester 1,000 acres. In the latter town there are also about 400 acres somewhat infested. Of the 2,000 acres of woodland at Woburn, approximately one-half in the southern part of the city is infested

by the moths in dangerous numbers, while the remainder has numerous scattering colonies. Stoneham has upward of 350 acres seriously infested in the southern part of the town, while 375 acres lying to the north are slightly infested. All the woodland in Medford in private hands, some 700 acres, is in a dangerous condition; and the same holds true at Malden, the area in the latter case being about 300 acres. Everett has 20 acres dangerously infested near and in the Woodlawn Cemetery; while in Revere there are about 75 acres of wood and brush land dangerously infested. Of the 1,200 acres in Melrose, all, with the exception of about 100 acres in the northern part of the city, should be considered dangerously infested. The moth occurs in smaller numbers in the remainder of the woodland area. The dangerously infested tract of woodland at Wakefield includes about 100 acres between Oak and Main streets, running easterly to the Saugus line. Some 400 acres are scatteringly infested. Saugus contains about 2,500 acres of woodland, all dangerously infested; and the same condition obtains in some 900 acres in the southern part of Lynnfield. In addition, there are about 1,000 acres in this town scatteringly infested. Some 4,700 acres of wood, sprout and brush land at Peabody contain scattering gypsy moth colonies, but none that are known to be in a dangerous condition at present. Of the woodland at Lynn, about 2,000 acres are held by the park and water boards, with 700 acres under private ownership. No part of this area is free from infestation; in fact, it all may well be put in the dangerous class. At Swampscott 250 acres are badly infested on the western side of the town, and about as much more on the eastern side is slightly infested. Marblehead has about 100 acres mildly infested; Salem, approximately 800 acres of wood and brush land, including the Great Pastures, severely infested, with about 100 acres more where the moth occurs in smaller numbers. At Beverly there are about 3,000 acres of woodland, much of which is old growth and contains many fine trees. This entire woodland area is scatteringly infested, the sections about Wenham Lake at North Beverly needing attention in the near future to keep the moth from developing in dangerous numbers.

Presented in tabular form, the areas by towns are given herewith: —

TOWN OR CITY.	Dangerously Infested (Acres)	Slightly Infested (Acres).
Arlington,	500	—
Belmont,	450	—
Beverly,	—	3,000
Everett,	20	—
Lexington,	1,000	1,000
Lynn,	2,700	—
Lynnfield,	900	1,000
Malden,	300	—
Marblehead,	—	100
Medford,	700	—
Melrose,	1,100	100
Peabody,	—	4,700
Revere,	75	—
Salem,	800	100
Saugus,	2,500	—
Stoneham,	350	375
Swampscott,	250	250
Wakefield,	100	400
Waltham,	50	2,950
Watertown,	50	—
Winchester,	1,000	400
Woburn,	1,000	1,000
	13,845	15,375 13,845
Total,		29,220

HOW THE GYPSY MOTH IS SPREAD.

The spread of the gypsy moth in eastern Massachusetts and across the State line into southern New Hampshire has resulted chiefly from human agencies. The female gypsy moth does not fly, and the natural spread of the insect is therefore slow. The principal means of distribution by human agency is the transportation of caterpillars of the moth upon vehicles. This occurs mainly in the spring and early summer before the caterpillars have grown too large to spin down on their threads from the trees. As in an apple orchard where canker worms, when numerous, drop down on fine threads upon the head and shoulders of the passer beneath, so along a street overhung with the arching branches of shade trees which are badly or only considerably infested the small gypsy moth caterpillars spin down. Whether a vehicle stands or passes beneath badly infested

trees, the chances are many that more or less of caterpillars will drop upon or be struck by it, and so be carried away from their original home. In a locality badly infested with the gypsy moth such a result is inevitable.

In 1889, the year of the great gypsy moth outbreak in Medford, the first general distribution of the insect took place from this point of original infestation. The statements of citizens vividly portray the swarming numbers of caterpillars then : —

The place simply teemed with them, and I used to fairly dread going down the street to the railroad station. It was like running a gauntlet. I used to turn up my coat collar and run down the middle of the street. One morning in particular I recall that I was completely covered with caterpillars, inside my coat as well as out.

When caterpillars swarmed and spun down like this, their transportation on carriages and wagons to points outside Medford was at its maximum.

The establishment of a colony of gypsy moths in outside territory depended largely upon the regular trips of vehicles to or from Medford. Regular traffic (*i.e.*, constant or recurring), daily or at stated intervals, such as teaming of certain sorts, trips of milkmen, market gardeners, butchers, bakers and peddlers, and of junk and swill carts making their rounds, between Medford and some point or points outside that city, finally resulted in the carriage of caterpillars to more or less of the localities where these vehicles stopped. While on a single trip enough caterpillars may be carried outside to a stopping place of a wagon or to the end of its route to bring about the establishment of a new moth colony, this is effected more surely by successive transportations of one or more individuals of the species. Even if on some occasions no caterpillars are carried out, the continually recurring trips back and forth of the vehicle make it only a question of time when enough will be taken to the outside point to establish there a new colony.

Pleasure driving in and out or through Medford, much of it, like traffic on wheels, constant and frequent between the

same points, also served to a less extent, because there was less of it than of the other, to establish the gypsy moths in new outside places.

A less regular distribution of the moth has resulted from the carriage or shipment outside the infested territory of objects upon which the eggs of the insect have been laid, such as cord wood, boxes, barrels, etc. As a gypsy moth egg cluster contains on the average some 500 eggs, a single transportation of an infested object, even if there were never another shipment, would be the easy means of the infestation of a new locality. While a certain per cent of the spread of the gypsy moth has been due to its transportation in the egg form, it is now known that far the greater part has taken place when the insect was in the active caterpillar stage.

In addition to the spinning down of young caterpillars from trees in residential districts, there are other ways by which vehicles become infested. When vegetation is rapidly being destroyed by caterpillars, as is the case when they are in great or overcrowding numbers in a place, they migrate in search of food. Vehicles which happen to stand in or near a spot where such conditions obtain (as a badly infested tract of roadside bushes or piece of woodland) soon become infested with caterpillars of all sizes, which are rapidly seeking "fresh fields and pastures new." No longer a period than five minutes may be required for a vehicle to become infested with scores of caterpillars. Even when the moths are not so thick as this, as in an orchard or yard, large caterpillars frequently crawl for shelter or for the purpose of pupating on the under sides of the bodies of wagons which stand beneath or near infested trees.

The great variety of ways by which distribution may be brought about is well illustrated by two cases out of many recorded in the summer of 1905. Following the celebration in June of the two hundred and seventy-fifth anniversary of the settlement of Medford, the bunting and flags which were used freely for decorative purposes all over the city were shipped elsewhere. Some of this material went out of the State. Following his usual practice of cleaning his bunting,

one decorator found on it some caterpillars. Here we have a possibility of transportation of the moths. While these caterpillars would have died before the bunting was used again, had the date of the celebration been a month later there would have been pupæ on the bunting as well as caterpillars; and if later still, egg clusters. The duration of the pupal stage is from eight to sixteen days, which might cover the time elapsing between the use of the bunting in an infested place and its use again in another. In the latter case, if pupæ arrived in the bunting uninjured, moths in due time would have emerged, egg clusters would have been laid and a new colony started.

On July 11 a State inspector saw a teamster unloading household goods in Andover. Learning that the furniture wagon had come from Medford, he examined the coverings of the load, and found concealed in the folds a dozen gypsy moth caterpillars. The date marked the height of the larval season, and these caterpillars were full grown. Here we have a case of transportation of large gypsy moth caterpillars. These full-grown caterpillars had crawled upon the wagon while it was stationary or else upon the goods before they were loaded. Here we have the complete evidence in a case of distribution from beginning to end.

The first great distribution of the gypsy moth practically ceased soon after 1889 because the exterminative work on the part of the State had so greatly diminished the numbers of the caterpillars along streets and highways. But in 1900, when the State work was abolished, the insect was allowed to increase again without hindrance, and a second great distribution into new outside territory resulted. In the old infested territory of 359 square miles the moths became after two years more or less plentiful, and by the third year their ravages were apparent in many places. Worse results were to follow. The rapid and unchecked multiplication of the moths not only caused their old colonies, many of which had been entirely cleared by the work of the State Board of Agriculture, to become reinfested, but also brought about in some of them such a swarming of caterpillars as had not been seen since 1889 in Medford. But now the

dangerous conditions of 1889 not only obtained again in parts of Medford, but in addition in scores of other localities in Malden, Melrose, Saugus, Arlington, Stoneham, Belmont, Winchester, Woburn and Cambridge. Beginning in 1903 and continuing with increasing force through 1904 and into the summer of 1905, the unchecked distribution of the gypsy moths from these centres into new sections went on; so that when the approximate limits of the territory occupied by them since 1900 had been determined by the State field work of the summer and fall of 1905, it was found that their habitat in eastern Massachusetts had increased in area over six-fold. It was also found that the moths had entered New Hampshire from Essex County, Massachusetts, and had obtained a foothold at least as far north as Portsmouth, — a notable centre of travel during the Peace Conference the past summer. History had repeated itself. As in 1891 it was learned that the moths had become widely distributed in the years 1888, 1889 and 1890, so in 1905 it became plain that the second great unchecked distribution had gone on during 1903, 1904 and 1905. In the extensive, newly infested area discovered by our inspectors it is undoubted that there was little infestation prior to 1900 (with the exception of the sporadic colony in Georgetown), which indicates that the diffusive energy developed in the old infested district after the abandonment of work there had been sufficient to infest, chiefly in three years' time, a wide area of new outlying territory.

In accounting for this alarming spread of the gypsy moth in comparatively so short a time, a new factor in the problem of distribution, in addition to the increase in the number of badly infested centres of diffusion, has to be considered — namely, the automobile. The horseless carriage must be held specially accountable for the presence of the gypsy moth to-day in so many remote or out-of-the-way localities in the territory infested within the last five years. In the second great distribution of the gypsy moth in 1903-05, the regular and constant traffic over the road, together with pleasure driving, continued as before the chief factor. But this, being so largely of a business nature, did not extend far out from the badly infested centres in the old moth terri-

tory. And while it is true also that the bulk of automobil-ing—as was the case with pleasure driving in 1889 and is to-day—is confined within a moderate radius from a centre of population, it is *not* true that the percentage of the longer trips is the same with both sorts of travel. The total of long drives in the case of the “auto” is greater in proportion to the whole than it is or ever was in the case of a carriage drawn by a horse. In other words, in proportion as horseless carriages have supplanted vehicles of the other sort, the percentage of long-distance journeys in the sum total of riding for pleasure is immeasurably greater than in the past.

The reason is not far to seek. The automobile, by reason of its speed and its machine-made method of progression which renders riders independent of all consideration of horseflesh, tempts to both long and erratic runs, and so has introduced a very irregular method of distribution. The use of a machine which possesses speed and lacks sensibility conduces to the invasion of sections necessarily unvisited by a vehicle drawn by a horse from a distant centre of population. Furthermore, the motor carriage incites to the exploration of new country, for its speed so broadens its scope of operation that no comparison of steam or gasoline with horseflesh is possible. And so the roads of eastern Massachusetts have been ridden over for pleasure more thoroughly than ever before, especially those out of the beaten track for carriages, and therefore comparatively little travelled before the advent of the automobile.

The speedy motor carriage making a long run from an infested starting place or passing through a badly infested locality might not necessarily go over the identical route again or reach the same objective point; but on its only run to this outside point it might carry enough caterpillars to establish there or *en route* a new colony of gypsy moths. By this means only is to be explained most of the moth colonies found remote from the central infested district in the area which has become infested since 1900. There is no question that in the “swarming year,” 1889, the same thing happened often, enough caterpillars being carried out on a

single trip of a vehicle from Medford to infest a new locality. But in 1889 the automobile was not in use nor for many years after; and so in ten years' time no far-away colonies of the gypsy moth, excepting the one in 1899 at Georgetown, were ever found as the result of the early outbreaks of the moth.

The increased percentage of long-distance riding for pleasure, due to the introduction of automobiles, makes it possible to account for the more frequent establishment of sporadic colonies of the gypsy moth than in the past, and for the scattering of the moths to a distance, as in southern New Hampshire and particularly in the country south of Boston. The great city lying to the north of Norfolk and Plymouth counties in a sense served for years as a barrier against invasion of moths from Medford and the other infested centres. It long escaped serious infestation itself, and its presence discouraged pleasure driving through it from the moth district to the untouched country to the southward. Neither Medford nor Malden in the late eighties took milk from Plymouth County farmers or supplied them with swill. Regular traffic over the road from near-by points naturally ended in the great city. In later years the few serious infestations which occurred in Boston itself, such as the Dorchester outbreak in 1895, contributed to some extent to cause the infestation of near-by territory by the usual means of hucksters', milk-dealers' and marketmen's wagons and of regular and constant pleasure driving. In illustration may be cited the contiguous city of Quincy, which has now become a secondary centre of infestation. Through teaming from the infested country north of Boston also has always slightly helped to carry the insect to the towns to the south of the city. But the automobile, which annihilates distance, must be held to be chiefly accountable in bringing about in recent years the infestation of the extensive country to the south of Boston over which the moths are now known to be scattered. The erratic as much as the long runs of the frequent automobile can alone explain the presence of the moths in few and scattered numbers, not only along main routes of travel, but in out-of-the-way

places as well, throughout the length and breadth of Plymouth County and on Cape Cod.

In a consideration of the automobile as a factor of distribution, it should be borne in mind that the short-distance runs, as well as the long, extend farther out from a centre of population than driving has ever done, for the reason that the machine has wonderfully extended the radius of travel for pleasure, absolutely as well as relatively, over that of the past. The inner towns of the new moth territory since 1900 are more thoroughly infested than those farther out, largely as a result of the quite regular and constant short-distance automobiling from the heart of the old badly infested moth district, which is constantly using the same highways and reaching the same objective points.

The considerable infestations at Newburyport, Rockport and Plymouth, all remote from the badly infested central district, which might seem at first to furnish an exception to this rule, in reality prove it. These places are objective points for much automobiling, and so in the natural course of events have become dangerously infested with the gypsy moth.

It is most unfortunate that the height of the automobiling season coincides with the period of greatest abundance of gypsy moth caterpillars. It has seemed desirable to collect data on the number of automobiles and other vehicles passing certain points in the infested district during a single day in the hours usually devoted to pleasure riding. The figures given below were obtained in the fall months, and would have been very much larger had a similar count been made during the months of May and June.

LOCALITY.	Automobiles.	Carriages, etc.
Arlington Square,	443	952
Medford Square,	256	655
Saugus (turnpike),	92	88
Newton (boulevard),	630	170
Quincy Square,	264	347
Franklin Park (Blue Hill Avenue),	724	961

CUTTING WORTHLESS TREES.

Dr. Charles S. Sargent, the celebrated arboriculturist, says, "There are too many trees in the metropolitan district," meaning, of course, that there are many trees which have never received the care and attention necessary to insure their best growth and development. Aside from the undesirable species, such as the wild cherry and scrub apple tree, there are not wanting trees on the majority of private estates that never receive the slightest care or attention. Never pruned, never fertilized, unprotected from damage by horses and thoroughly infested by insect pests, such trees either should be properly cared for or else removed. Since the moth pests have now become thoroughly established in eastern Massachusetts, it should be laid down as a rule that no man should be allowed to maintain more trees than he can properly care for. A thrifty, vigorous tree, protected from insect injury, is a delight to the eye, and adds to the value of the property on which it stands; a neglected, injured, diseased tree is an offensive object, reflects adversely on those who allow such conditions to prevail, and in the moth district actually depreciates the value of real estate. Thus we are led to urge the general cutting of worthless, diseased and uncared-for trees.

We yield to no one in our admiration of the beautiful in nature as exemplified in vigorous tree life; but we cannot see the wisdom of allowing worthless growths to remain by roadsides or in back yards and lots, to breed the pests from which we are striving to protect our streets and residential districts.

The co-operation of many citizens in the work against the gypsy moth has been evidenced within a few months in a striking way by the extensive cutting down of such old or worthless trees throughout the infested district. Many old apple orchards of dead or dying trees have disappeared from the landscape while scattering trees too few to be dignified with the name of orchard, which had outlived their usefulness, have similarly vanished. Every one will recall the frequency of occurrence in the thickly populated section of

eastern Massachusetts of old, decayed, hollow apple trees, the last remnants of once flourishing orchards, standing in vacant lots or along roadsides in city or town outskirts. Such unsightly trees have been always notorious breeding places for the moths, and their destruction is a distinct help in the progress of the work against these pests. In addition to the removal of such worthless trees, a great number of other trees have been improved by the beneficial pruning of dead or decayed limbs, and the closing of cavities, for the reason, primarily, that these furnished shelter for the moths. Not only apple trees, but also decayed or otherwise unsightly shade trees and worthless trees, such as wild cherries, have been cut down to further the present campaign against the moth pests. A judicious thinning out of trees that grew too thickly in yards or along roadsides has also taken place. By this means a double benefit has been brought about; first, to the moth suppressive work, for the reason that every tree removed is one tree less to handle with reference to the moths; and, second, to the trees left standing, which, by the removal of some of their number, were given room for development.

Badly infested tracts of woodland also have frequently been cut down, as the most effective and summary means of doing away with intolerable conditions, and with the added purpose of saving expense in the long run to the owner. While this has resulted in denuding land here and there, it has been the ready means of relief for the citizens afflicted, and has aided most materially the work of clearing the moths from near-by or adjoining public lands. This cutting has been generally on low-cost woods which would eventually be removed, when the land which was being held for a rise in values and had been already cut up into house lots in expectation of the growth of the community would be built upon.

When land has not been entirely denuded of woods, there has been often much judicious thinning out of trees, which has resulted in a distinct benefit to those left standing, on a principle familiar to every forester.

In addition to trees, a great deal of useless smaller

growth and bushes, not only along roadsides and on vacant lots but also in yards and cultivated fields, has been removed, for the reason either that it was exposed to infestation by the moths or was already infested. Along with this removal of trees and brush has gone on much general clearing up of estates, such as the burning of old brush heaps, doing away with dumps, removal of rubbish and cleaning up of vacant lots. To give a concrete instance, in the city of Melrose, where the suppressive work has been pushed with vigor by the local superintendent, there were gathered on private and public grounds twenty-seven cart loads of tin cans,—notorious nesting places for gypsy moths.

WORK OF CONTRACTORS.

Owing to the difficulties which attend the efforts of private citizens in combating the moths, such as lack of suitable apparatus and of special knowledge of the insects, it is not strange that in eastern Massachusetts there has sprung up a new industry, and that many individuals and concerns are now engaged in the business of destroying the pests, both on public and private grounds. Over a dozen concerns are so engaged, together with scores of individual workers. Many of these have done most efficient work. The superintendent has prepared a list of contractors who on their records are believed to be reliable and efficient, and has supplied it to inquirers upon request.

It is greatly regretted that along with this development of a legitimate enterprise numerous irresponsible persons have engaged in the business, with the result that many citizens, desirous of destroying the moth pests on their property, have been badly swindled. A great deal of inefficient work has thus been done, and, as a consequence, many property owners have been discouraged from employing reputable contractors. In a few cases, where suitable evidence could be secured, the superintendent has been instrumental in having certain swindlers put into court. Lacking any specific control over the situation, the policy of publicity has seemed to be the only remedy, and we have not hesitated to expose persons known to be unreliable.

DESIRABLE SHADE TREES.

Since the gypsy and brown-tail moths have been allowed to multiply unrestrained throughout the district, certain natural preferences of the insects in the way of food plants have been noticed which had hitherto escaped observation. It has been found that certain species of trees are to a notable extent fairly exempt from damage by these moths. Thus it is apparent, therefore, that in planting such trees it is possible to select several species which will be less troubled by these insects than those commonly in use.

Perhaps the most notable example of relative freedom from damage by the moths is found in the case of the white ash. The leaves of this tree do not lend themselves readily to the construction of brown-tail moth webs, while the gypsy moth does not feed upon it to any extent so long as other trees are available. In fact, in the badly stripped woodland areas last summer the comparative exemption of the white ash from damage was very noticeable. It was found that in areas of several acres the only trees retaining even a part of their foliage were those of this species. Since the white ash makes a rapid growth and is otherwise desirable as a shade tree, it seems advisable to make a more liberal use of this tree for planting purposes along streets, in parks and on private estates in the infested district.

The soft maple, or, as it is more commonly known, the red maple, also shows a considerable degree of freedom from attack by both insects. While it is not uncommon to find the nest of either species of moth on this tree, yet at the same time it deserves to stand in the second rank. The smooth bark of this maple offers but little shelter to the caterpillars, particularly on the younger trees, while the brown-tail moth webs are not easily formed in its foliage.

Various species of hickory are but little sought by the gypsy moth caterpillars, and are practically free from brown-tail moth webs as well. It is to be stated, however, that in the case of the older trees of this class the rough bark offers an excellent hiding place for gypsy moth caterpillars, and the latter insect pupates freely under the shelter of the bark.

This tree has also the disadvantage of making a relatively slow growth, and often is not as desirable for planting as the ash.

NEW METHODS.

It is in some ways remarkable that in the period that has elapsed since the cessation of the former State work against the moths but few new methods of work against the pest have been developed. One might have thought that, with so many hundreds if not thousands of intelligent property owners engaged in protecting their trees from damage, some few at least would have hit upon a new or more economical means of performing at least a part of the work.

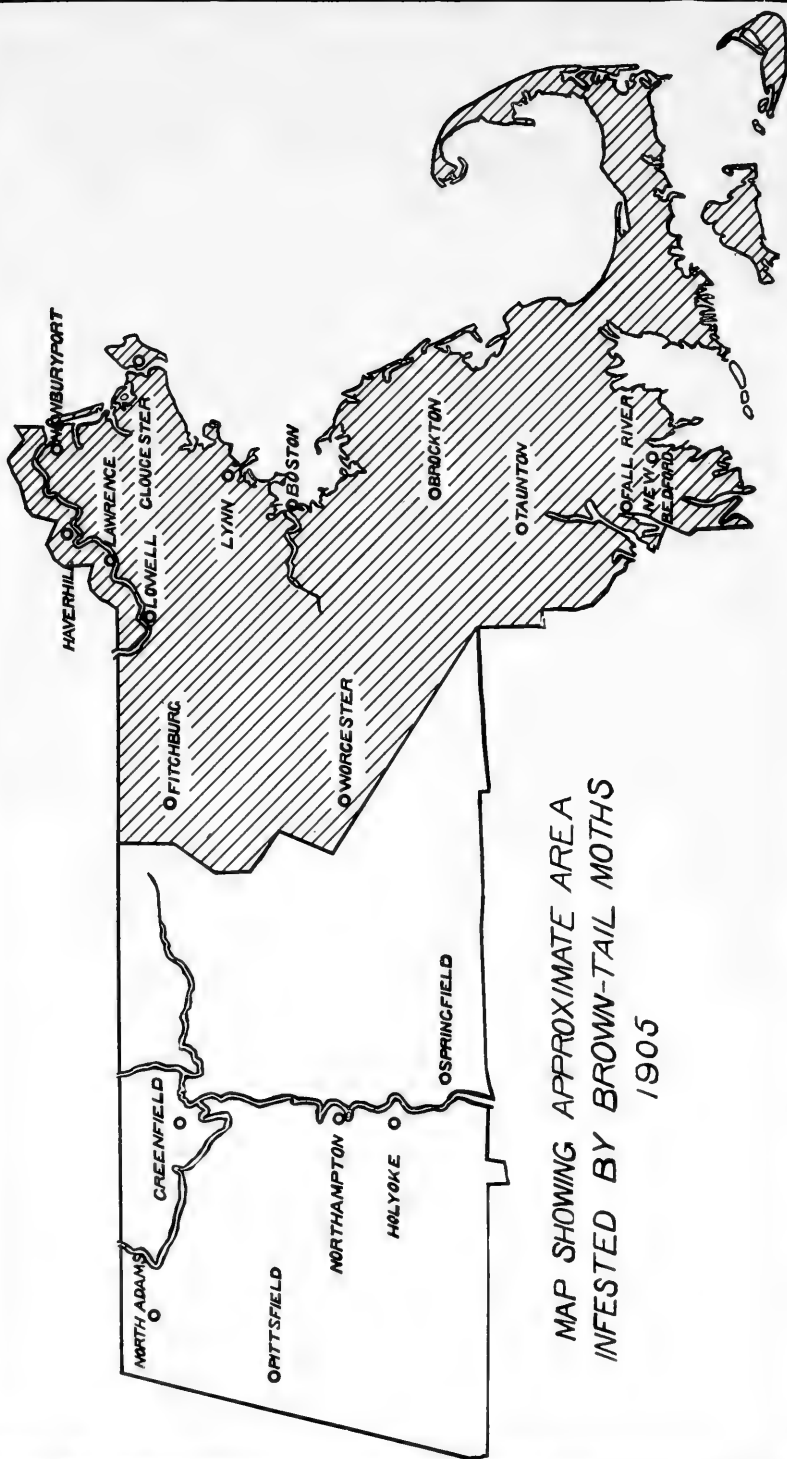
The only method absolutely new is that brought out by Superintendent Charles P. Price of the Middlesex Fells Reservation, to prevent the crossing of roads by the caterpillar swarms. It often happens in woodland that large caterpillar colonies swarm from the stripped areas across roads into woods that are in good foliage. Mr. Price to some extent has been able to prevent this by a small windrow of marsh hay sprinkled with low-grade burning oil. These windrows are continued along the roadside, and when frequently treated with oil form a barrier over which the insects cannot pass.

The banding of trees with sticky materials to prevent the ascent of caterpillars, while long used abroad and adopted in the years of the former State work, has received a new impetus from the development of a most excellent compound, "Tanglefoot," which was extensively used the past year, and in many cases with most satisfactory results. The successful use of any banding material presupposes that the trees have been freed from the moth in the first place, either through nest destruction or by spraying. Nothing is gained by banding trees already infested. On the other hand, trees previously cleared of the moth, but standing in a badly infested district, may be protected in a great measure by banding. This method is particularly serviceable in woodlands and on street trees where the latter stand in or near a badly infested spot. Promiscuous banding of street trees without reference to surrounding conditions is not to be recommended.

A great objection to many banding materials is found in the fact that some of them, if left on through the late summer and fall, ultimately injure and sometimes kill the tree. This, of course, is most noticeable with young or thin-barked trees. So far as our observations go, the "Tanglefoot" bands have caused no injury. Another season will yield conclusive evidence on this point.

There is no better or cheaper way to control either moth pest than by spraying, where conditions favor this work. Street trees, orchards and easily accessible woodland areas can usually be sprayed to advantage where time permits. The great impediment to wholesale spraying, however, is found in the fact that it can be done to advantage only in the period between May 15 and June 30 at the latest (usually June 15), and this limited space of time is often still further reduced by rains, so that as a rule but four weeks on the average are available for this work. The superintendent has repeatedly urged on the badly infested municipalities the wisdom of purchasing one or more power spraying outfits, so that next season we may take full advantage of a method, which, from the late date at which operations were begun this year, was out of the question.

An excellent illustration of spraying methods as applied to woodlands was given at Melrose in the latter part of May by the Massachusetts Society for Promoting Agriculture, under the direction of Superintendent J. A. Pettigrew of the Boston park department. These spraying operations attracted a great deal of attention, and were witnessed by a large number of park superintendents, tree wardens and other interested citizens. Unfortunately, the success of the experiment was adversely affected by the severe infestations in the surrounding woodland, but the result of this demonstration was to arouse a greater interest in this method of fighting the moths. It is the hope of the superintendent that, with the opportunities now offered to purchase power sprayers at a moderate price, spraying will become more generally adopted by the local superintendents of moth work in cities and towns.



MAP SHOWING APPROXIMATE AREA
INFESTED BY BROWN-TAIL MOTHS
1905

NATIONAL AID.

The problem of moth control is no longer confined to a single State ; three States are infested by the gypsy moth and four by the brown-tail moth. If any permanent headway is to be made against these insects, co-operation between the States is a prerequisite condition ; and this, it would appear, can be best obtained through the assistance of the national government.

In the case of the brown-tail moth there is no hope of exterminating it, and even its control in woodlands is out of the question, because of the expense involved. As previously pointed out, this insect can be easily destroyed, even by unskilled persons, and there is no good reason why property owners should not be able to protect their shade and fruit trees from it. Further than this they cannot go without incurring, in the majority of cases, unwarranted expense.

With the gypsy moth the case is different. Here we have a slowly spreading insect, as yet confined to a limited section of New England. With sufficient funds it can be held in check. Without means for a thorough campaign of suppression, a further spreading is bound to take place. This insect attacks not a single crop, as does the cotton boll weevil, already the cause of large expenditures of national funds, but all fruit, shade and forest trees ; it threatens our orchards, street trees and parks ; in woodlands it leaves behind dead pines, spruces and other conifers while many of the deciduous trees eventually succumb.

Massachusetts has proven beyond any question or doubt that this pest can be controlled. At one time she gave to the nation an example of the successful solution of the greatest problem in applied entomology ever known, — although ceasing too soon her efforts. She has shown the faith that is within her by an unprecedented expenditure of funds to preserve her trees. In protecting herself she has protected at least the rest of New England. If ever a State was entitled to national aid in a worthy cause, that State is Massachusetts.

OUTLOOK FOR CONTROL.

It is never well to underestimate the strength of an antagonist. In fighting the gypsy moth we must take into consideration its insidious habits, its great powers of multiplication, the ease with which it is now accidentally spread, and the cost and difficulties involved in destroying it even on small estates. These difficulties are multiplied many fold by the conditions existing in thousands of acres of severely infested woodland. The citizens of the State are paying the bills for fighting the moth; it is their money in one way or another which is being used to prosecute this work; and, in justice to the taxpayer, the adverse as well as the favorable conditions should be fully presented.

It is evident that the present act will not, even with closest economy, yield more than sufficient revenue to suppress the gypsy and brown-tail moths on public trees and in residential sections. The petitioners for legislation against the moths, having a knowledge of the fact that the gypsy moth occurred in 43 cities and towns, while the brown-tail had extended its domain over nearly one-half the State, asked the Legislature to appropriate \$600,000 for three years' work, above the sums to be raised by local taxation. But at the present time there are 124 municipalities which are known to be infested by the gypsy moth, while the brown-tail moth is rapidly spreading, and we have only \$300,000 of State appropriation with which to accomplish the desired results. It is obvious that with one-half the required funds but one-half the work can be done. We believe that under present conditions we can prevent a farther spreading of the gypsy moth into non-infested territory, and can largely control damage from either pest on street trees and in residential districts. Owing to the late date at which the work began in 1905, the success of our efforts in this direction will not be determined until after the caterpillar season of next year and the fall inspection.

As a matter of fact, we shall be unable to clear even the residential sections of the moths, unless we can have in liberal measure the hearty co-operation of all citizens. So far

as the work on private estates is concerned, if the disposition now in evidence on the part of many to take refuge under the "half of one per cent" clause is to be generally followed, the State may as well stop the work now; since, unless citizens will co-operate with local and State authorities, and perform their full duty not only to themselves but to their neighbors, no permanent benefit can be obtained.

The outlook for controlling the gypsy and brown-tail moths is hopeful within the limits previously mentioned. It will, of course, be impossible to attack the moths in the woodlands generally until suitable funds are available; but the scattering of the gypsy moth can be stopped, our street trees protected and our residential sections kept partially free from damage by the swarming caterpillars, even with the present reduced appropriation. But to accomplish this there must be no faltering along the line; there must be no apathy or indifference on the part of any one concerned. A chain is no stronger than its weakest link; and to bring success, thorough and efficient work must be done in each and every infested municipality. This is an effort made for the preservation of our shade trees, fruit trees and woodlands; their safety is threatened by attacks of serious insect pests. Sound business policy in any enterprise requires the employment of the most efficient men for a given rate of wages, and the purchase of supplies at bottom market prices. No other rule of procedure should obtain in carrying out the provisions of the gypsy and the brown-tail moth act. If there ever was a public enterprise which ought to be kept free from local political considerations, and handled in a thoroughly business-like manner, it is the work against the gypsy and brown-tail moths. If we can have the whole-hearted interest and support of the public, if we can have effective and economical local administrations of work, and if the central office does its full duty, then the pests can be brought under control, and our parks, street trees and private grounds preserved from harm.

The success of this undertaking does not depend alone upon the central organization; it does not depend upon the man in charge of any particular city or town, nor upon any

individual citizen; but it does depend upon the business-like, sincere, hearty co-operation of all concerned in suppressing the moths and preserving our trees. In short, the moth pests can be suppressed if all work together with a common purpose and for a common end. No city or town can be allowed to slight this important work; no citizen should be permitted to maintain a nuisance, to his neighbor's annoyance or detriment.

RECOMMENDATIONS.

It is too early as yet to state with any degree of completeness the possible amendments which may be required to the act under which we are working; but, to secure a greater uniformity and efficiency of action throughout the infested district, it is apparent to the superintendent that certain minor changes at least are desirable. As yet the act has not been tested sufficiently in all its details to develop any insurmountable difficulties in its execution, with a single exception, viz., the omission of the word "caterpillars" from sections 4 and 6.

The superintendent, however, presents for your consideration the following proposed changes in the existing law, as based upon the experience of the past six months:—

1. The State superintendent, as well as those locally in charge of the work in cities and towns, should be given sufficient authority to prevent the use of ineffective measures against the moths, or of those which tend to distribute the insects. Several irresponsible contractors have swept gypsy moth egg clusters from the trees to the ground, or left brown-tail moth webs lying on the ground, in spite of the fact that it is well known that such eggs or webs will yield a large percentage of caterpillars to reinfest the trees.

2. The State and local authorities should be given power to control as may be necessary the transportation of wood, timber and any other objects infested by the moth pests. At the present time any one may ship from the central district a carload of infested wood to any point in Massachusetts or other State, there to establish a new moth colony. The authority to prevent such a disaster the superintendent deems of the highest importance.

3. As the present act is worded, work against gypsy or brown-tail moth *caterpillars* cannot be made compulsory either in the case of cities or towns or on private estates. The omission of the word “caterpillars” in the act, doubtless the result of oversight, should be remedied, since otherwise the purpose of the act may be defeated.

4. The superintendent is of the opinion that the act should be so amended as to clearly place the appointing power of the local superintendent in the hands of mayors of cities and selectmen of towns. As the matter stands at present, the legal right of selectmen to appoint local superintendents without calling a special town meeting is not clearly established.

5. It seems advisable to extend the provisions of the civil service act to all those engaged under chapter 381, Acts of 1905, in the work of suppressing the moths. A practical, competitive examination should result in securing a list of employees possessing good eyesight and physical ability to climb trees, both qualifications indispensable in the field work.

6. Finally and most important, it should be said that if the purposes of the act are to be carried out throughout the greatly enlarged infested district, an additional appropriation equal to that of 1906 will be necessary. The funds available are about sufficient to keep street and public trees free from the moths. With the present appropriation but little work can be done on private estates in excess of the owners' liability and practically none in the infested woodlands, which are the chief source of danger.

Respectfully submitted,

A. H. KIRKLAND,

Superintendent.



